ABBREVIATIONS

ABV	above
AFF	above finish floor
ASC	above suspended ceiling
ACC	access
ACFL	access floor
AP	access panel
AC	acoustical
ACPL	acoustical plaster
ACT	acoustical tile
ACR	acrylic plastic
ADD	addendum
ADH	adhesive
ADJ	adjacent
ADJT	adjustable
AGG	aggregate
A/C	air conditioning
ALT	alternate
AL	aluminum
ANC	anchor, anchorage
AB	anchor bolt
ANOD	anodized
APX	approximate
ARCH	architect (ural)
AD	area drain
ASB	asbestos
ASPH	asphalt
AT	asphalt tile
AUTO	automatic
BP	back plaster (ed)
BSMT	basement
BRG	bearing
BPL	gaging plate
BJT	bed joint
BM	bench mark
BEL	below
BET	between
BVL	beveled
BIT	bituminous
BLK	block
BLKG	blocking
BD	board
BW	both ways
BOT	bottom
BRK	brick
BRZ	bronze
BLDG	building
BUR	built up roofing
BBD	bulletin board
CAB	cabinet
CAD	cadmium
CPT	carpet (ed)
CSMT	casement
CI	cast iron
CIPC	cast-in-place concrete
CST	cast stone
CB	catch basin
CK	calk (ing) caulk (ing)
CLG	ceiling
CHT	ceiling height
CEM	cement
CPL	cement plaster (portland)
CM	centimeter (s)
CER	ceramic
CT	ceramic tile
CMT	ceramic mosaic (tile)
CKBD	chalkboard
CHAM	chamfer
CR	chromium (plated)
CIR	circle
CIRC	circumference
CLR	clear (ance)
CLS	closure
COL	column
COMB	combination
COMPT	compartment
COMPO	composition (composite)
COMP	compress (ed), (ion), (ible)
CONC	concrete
CMU	concrete masonry unit
CX	connection
CONST	construction
CONT	continuous or continue
CONTR	contract (or)
CLL	contract limit line
CJT	control joint
CPR	copper
CG	corner guard
CORR	corrugated
CTR	counter
CFL	counterflashing
CS	countersink
CTSK	countersunk screw
CRS	course (s)
CRG	cross grain
CFT	cubic foot
CYD	cubic yard
DPR	damper
DP	dampproofing
DL	dead load
DEM	demolish, demolition
DMT	demountable
DEP	depressed
DLT	detail
DIAG	diagonal
DIAM	diameter
DIM	dimension
DPR	dispenser
DIV	division
DR	door
DA	doubleacting
DH	double hung
DTA	dovetail anchor
DTS	dovetail anchor slot
DS	downspout
D	drain
DRB	drainboard
DT	drain tile
DWR	drawer
DWG	drawing
DF	drinking fountain
DW	dumbwaiter
EF	each face
E	east
ELEC	electric (al)
EP	electrical panelboard
EWC	electric water cooler
EL	elevation
ELEV	elevator
EMER	emergency
ENC	enclose (ure)
EQ	equal
EQP	equipment
ESC	escalator
EST	estimate
EXCA	excavate
EXH	exhaust
EXG	existing
EXMP	expanded metal plate
EB	expansion bolt
EXP	exposed
EXT	exterior
EXS	extra strong
FB	face brick
FOC	face of concrete
FOF	face of finish
FOM	face of masonry
FOS	face of studs
FF	factory finish
FAS	fasten fastener
FBD	fiberboard
FN	fence
FGL	fiberglass
FIN	finish (ed)
FFE	finished floor elevation
FFL	finished floor line
FA	fire alarm
FBRK	fire brick
FE	fire extinguisher
FEC	fire extinguisher cabinet
FHS	fire hose station
FPL	fireplace
FP	fireproof
FRC	fire-resistant coating
FRT	fire-retardant
FLG	flashing
FHMS	flathead machine screw
FHWS	flathead wood screw
FLX	flexible
FLR	floor (ing)
FLCO	floor cleanout
FD	floor drain
FPL	floor plate
FLUR	fluorescent
FJT	flush joint
FTG	footing
FRG	forged
FND	foundation
FR	frame (d), (ing)
FRA	fresh air
FS	full size
FBO	furnished by others
FUR	furred (ing)
FUT	future
GA	gage, gauge
GV	galvanized
GI	galvanized iron
GP	galvanized pipe
GSS	galvanized steel sheet
GKT	gasket (ed)
GC	general contract (or)
GL	glass, glazing
GLB	glass block
GLF	glass fiber
GCMU	glazed concrete masonry units
GST	glazed structural tile
GB	grab bar
GD	grade, grading
GRN	granite
GVL	gravel
GF	ground face
GT	grout
GPDW	gypsum dry wall
GPL	gypsum lath
GPPL	gypsum plaster
GPT	gypsum tile
HH	handhold
HBD	hardboard
HDW	hardware
HWD	hardwood
HJT	head joint
HDR	header
HTG	heating
HVAC	heating/ventilation/air conditioning
HD	heavy duty
HT	height
HX	hexagonal
HES	high early-strength
HC	hollow core
HM	hollow metal
HK	hook (s)
HOR	horizontal
HB	hose bibb
HWH	hot water heater
INCIN	incinerator
INCL	include (d), (ing)
ID	inside diameter
INS	insulate (d), (ion)
INSC	insulating concrete
INSF	insulating fill
INT	interior
ILK	interlock
INTM	intermediate
INV	invert
IPS	iron pipe size
JC	janitor's closet
JT	joint
JF	joint filler
J	joist
KCPL	keene's cement plaster
KPL	kickplate
KIT	kitchen
KO	knockout
LBL	label
LAB	laboratory
LAD	ladder
LB	lag bolt
LAM	laminate
LAV	lavatory
LH	left hand
L	length
LT	light
LC	light control
LP	lightproof
LW	lightweight
LWC	lightweight concrete
LMS	limestone
LTL	lintel
LL	live load
LVR	louver
LPT	low point
MB	machine bolt
MI	malleable iron
MH	MH manhole
MFR	manufacture (er)
MRB	marble
MFR	manufacture (er)
MAS	masonry
MO	masonry opening
MTL	material (s)
MAX	maximum
MECH	mechanic (al)
MC	medicine cabinet
MED	medium
MBR	member
MMB	membrane
MET	metal
MFD	metal floor decking
MTFR	metal furring
MRD	metal roof decking
MTHR	metal threshold
M	meter
MM	millimeter (s)
MWK	millwork
MIN	minimum
MIR	mirror
MISC	miscellaneous
MOD	modular
MLD	molding, moulding
MR	mop receptor
MT	mount (ed), (ing)
MOV	movable
MULL	mullion
NL	nailable
NAT	natural
NI	nickel
NR	noise reduction
NRC	noise reduction coefficient
NOM	nominal
NOM	nonmetallic
N	North
NIC	not in contract
NTS	not to scale
OBS	obscure
OC	on center (s)
OP	opaque
OPG	opening
OJ	open-web joist
OPP	opposite
OPH	opposite hand
OPS	opposite surface
OD	outside diameter
OHMS	ovalhead machine screw
OHWS	ovalhead wood screw
OA	overall
OH	overhead
PNT	paint (ed)
PNL	panel
PB	panic bar
PTD	paper towel dispenser
PTR	paper towel receptor
PAR	parallel
PK	parking
PBD	particle board
PTN	partition
PV	pave (d), (ing)
PVMT	pavement
PED	pedestal
PERF	perforate (d)
PERI	perimeter
PLAS	plaster
PLAM	plastic laminate
PL	plate
PG	plate glass
PWD	plywood
PT	point
PVC	polyvinyl chloride
PE	porcelain enamel
PTC	post-tensioned concrete
PCF	pounds per cubic foot
PFL	pounds per linear foot
PSF	pounds per square foot
PSI	pounds per square inch
PCC	precast concrete
PFB	prefabricate (d)
PFN	prefinished
PRF	preformed
PSC	prestressed concretee
PL	property line
QT	quarry tile
RBT	rabbet, rebate
RAD	radius
RL	rail (ing)
RWC	rainwater conductor
REF	reference
RFL	reflect (ed),(ive)(or)
REFR	refrigerator
REG	register
RE	reinforce (d), (ing)
RCP	reinforced concrete pipe
REM	remove
RES	resilient
RET	return
RA	return air
RVS	reverse (side)
REV	revision (s), revised
RH	right hand
ROW	right of way
R	riser
RVT	rivet
RD	roof drain
RFH	roof hatch
RM	room
RO	rough opening
RB	rubber base
RBT	rubber tile
RBL	rubber stone
SFGL	safety glass
SCH	schedule
SCN	screen
SNT	sealant
STG	seating
SEC	section
SSK	service sink
SHTH	sheating
SHT	sheet
SG	sheet glass
SH	shelf, shelving
SHO	shore (d), (ing)
SIM	similar
SKL	skylight
SL	sleeve
SC	solid core
SP	sound proof
S	south
SPC	spacer
SPK	speaker
SPL	special
SPEC	specification(s)
SQ	square
SST	stainless steel
STD	standard
STA	station
ST	steel
STO	storage
SD	storm drain
STR	structural
SCT	structural clay tile
SUS	suspended
SYM	symmetry (ical)
SYN	synthetic
SYS	system
TKBD	tackboard
TKS	tackstrip
TEI	telephone
TV	television
TC	terra cotta
TZ	terrazo
THK	thick (ness)
THR	threshold
TPTN	toilet partition
TPD	toilet paper dispenser
TQL	tolerance
T&G	tongue and groove
TSL	top of slab
TST	top of steel
TW	top of wall
TB	towel bar
TR	transom
T	tred opening
TYP	typical
UC	undercut
UNF	unfinished
UR	urinal
VJ	v-joint
VB	vapor barrier
VAR	varnish
VNR	veneer
VRM	vermiculite
VERT	vertical
VG	vertical grain
VIN	vinyl
VAT	vinyl asbestos tile
VB	vinyl base
VF	vinyl fabric
VT	vinyl tile
WSCT	wainscot
WTW	wall to wall
WH	wall hung
WC	water closet
WP	waterproofing
WR	water repellent
WS	waterstop
WWF	welded wire fabric
W	west
WHB	wheel bumper
W	width, wide
WIN	window
WG	wired glass
WM	wire mesh
WO	without
WD	wood
WB	wood base
WPT	working point
WI	wrought iron

MATERIALS LEGEND

- CONTINUOUS WOOD BLOCKING
- NON-CONTINUOUS WOOD BLOCKING (SHIM)
- STEEL
- GYPSUM BOARD
- PLYWOOD
- RIGID INSULATION
- BATT INSULATION
- CONCRETE MASONRY UNITS

SYMBOLS

- X/AX.X — ELEVATION SYMBOL
- X/AX.X — SECTION/DETAIL SYMBOL
- X — WALL TYPE SYMBOL
- X — WINDOW SYMBOL
- ROOM NAME / RM # / FIN # — ROOM NAME & NUMBER SYMBOL, FINISH NUMBER
- XX — DOOR SYMBOL
- X — STOREFRONT SYMBOL

GENERAL NOTES

1. ALL CONSTRUCTION INCLUDING MATERIAL AND WORKMANSHIP, SHALL CONFORM TO THE 2018 INTERNATIONAL BUILDING CODE.
2. ALL ASTM STANDARDS LISTED HERE WITHIN, SHALL BE AS REFERENCED IN THE LATEST ISSUE OF THE ANNUAL BOOK OF STANDARDS OF THE AMERICAN SOCIETY FOR TESTING AND MATERIALS
3. THE CONTRACTOR, SHALL FIELD VERIFY ALL DIMENSIONS, ELEVATIONS AND SITE CONDITIONS BEFORE BEGINNING WORK. THE ARCHITECT AND ENGINEER, SHALL IMMEDIATELY BE NOTIFIED IN WRITING OF ANY DISCREPANCIES.
   THE CONTRACTOR SHALL CAREFULLY STUDY AND COORDINATE THE MECHANICAL, PLUMBING, AND ELECTRICAL SYSTEMS WITH THE ARCHITECTURAL WORK PRIOR TO INSTALLATION AND SHALL NOTIFY THE ARCHITECT IN WRITING OF ALL APPARENT INCONSISTENCIES FOR CLARIFICATION.
4. ALL OMISSIONS AND OR CONFLICTS BETWEEN THE VARIOUS ELEMENTS OF THE WORKING DRAWINGS AND SPECIFICATIONS, SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT OR ENGINEER. WORK SHOULD NOT PROCEED UNTIL A SOLUTION IS GIVEN BY THE ARCHITECT OR ENGINEER.
5. IN CASE OF CONFLICTS BETWEEN GENERAL NOTES AND DETAILS, THE DETAILS, SHALL TAKE PRECEDENCE OVER THE GENERAL NOTES. TYPICAL DETAILS, SHALL BE USED WHENEVER APPLICABLE. REFER TO SPECIFICATIONS FOR INFORMATION NOT COVERED BY THESE NOTES OR DRAWINGS.
6. IF A SPECIFIC DETAIL IS NOT SHOWN FOR ANY PART OF WORK, THE CONSTRUCTION, SHALL BE THE SAME AS FOR SIMILAR WORK.
7. COORDINATE FOUNDATION PLANS AND MECHANICAL DRAWINGS, FOR ALL OPENINGS, INSERTS AND OTHER RELATED ITEMS.
8. DIMENSIONS ARE TO FINISH FACE OF WALLS UNLESS NOTED OTHERWISE.
9. ADDITIONAL MISCELLANEOUS STEEL ITEMS NOT SHOWN ON STRUCTURAL DRAWINGS MAY BE REQUIRED. GENERAL CONTRACTOR AND FABRICATOR SHALL COORDINATE ALL REQUIREMENTS AND SHALL NOTIFY THE ARCHITECT IN WRITING OF ALL APPARENT INCONSISTENCIES FOR CLARIFICATION. (SUCH AS SIMPSON STRONG TIES)
10. DO NOT DIMENSION THIS DRAWING. ANY DIMENSIONS, QUESTIONS, SHOULD BE DIRECTED TO THE ARCHITECT OR ENGINEER.

PROJECT CONTACTS

ARCHITECT:
RUDY MOLINA, A.I.A.
MILNET ARCHITECTURAL SERVICES
608 S. 12th STREET
Mc ALLEN, TEXAS 78501
(956) 688-5656

OWNER:
HIDALGO COUNTY
100 E. CANO STREET
EDINBURG, TX 78539
(956) 318-2600

MEP:
TRINITY MEP ENGINEERING
3533 MORELAND DR.
WESLACO, TX 78596
(956) 973-0500

CIVIL:
CHLH ENGINEERING, LLC
701 S 15TH ST
MCALLEN, TX 78501
(956) 687-5560

STRUCTURAL:
SOLORIO, INC.
108 CLEO DAWSON
MISSION, TX 78572
(956) 631-1500

GENERAL CONTRACTOR:
GC NAME
COMPANY
ADDRESS
CITY, STATE ZIP CODE
PHONE NUMBER

INDEX OF DRAWINGS

GENERAL INFORMATION
A0.0 COVER SHEET
G2.0 EGRESS PLAN

CIVIL
C1.0 HORIZONTAL & VERTICAL CONTROL PLAN
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C4.0 EROSION & SEDIMENT CONTROL PLAN
C5.0 SITE DETAILS
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C6.0 SITE DETAILS
C7.0 SITE DETAILS

STRUCTURAL
S101 SPECS
S102 SPECS
S201 FOUNDATION PLAN
S301 ROOF FRAMING PLAN
S401 SITE DETAILS
S402 FOUNDATION DETAILS
S403 FRAMING DETAILS
S404 CMU DETAILS

ARCHITECTURAL
AS1.0 SITE PLAN
AS1.1 SITE DETAILS
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A3.0 ENLARGED PLANS
A3.1 RESTROOM ELEVATIONS
A3.4 KITCHEN PLAN
A4.0 REFLECTED CEILING PLAN
A5.0 BUILDING SECTIONS
A5.1 WALL SECTION
A5.3 ROOF PLAN
A6.0 INTERIOR ELEVATIONS
A7.0 DOOR SCHEDULE
A7.2 STOREFRONT TYPES
A7.1 DOORS & WINDOW TYPES
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MP01 MECHANICAL FLOOR PLAN
MS01 MECHANICAL SCHEDULES
MC01 MECHANICAL DETAILS
MC02 MECHANICAL DETAILS
MD01 MECHANICAL DETAILS
E0.0 ELECTRICAL SCHEDULES
ES1.1 ELECTRICAL SITE PLAN
E1.1 ELECTRICAL LIGHTING PLAN- FIRST FLOOR
E2.1 ELECTRICAL POWER FLOOR PLAN- FIRST FLOOR
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ET2.4 MDF/IDF RACK DETAILS
P1.1 PLUMBING SEWER - FIRST FLOOR
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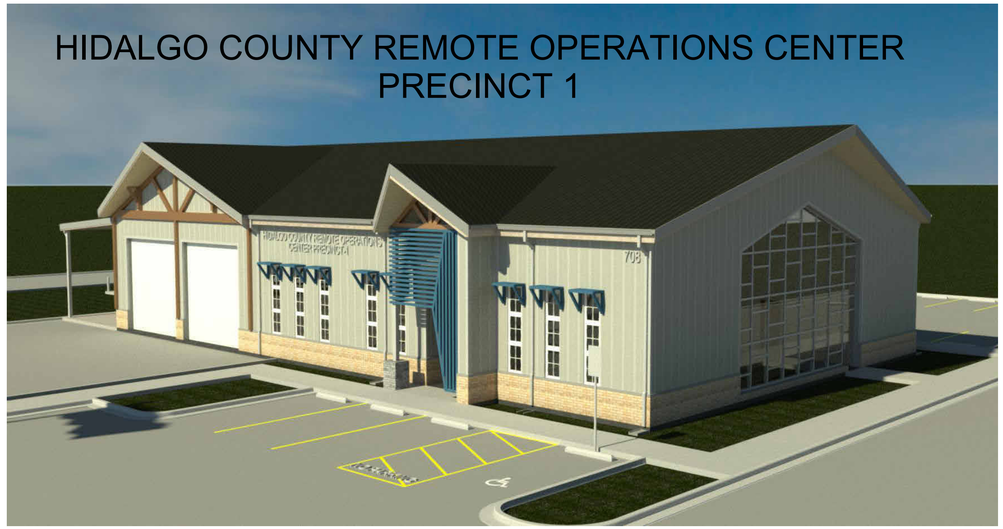
P2.2 PLUMBING DIAGRAM
P3.1 PLUMBING SCHEDULES
P4.1 PLUMBING DETAILS
P4.2 PLUMBING DETAILS
FP01 FIRE PROTECTION SITE PLAN

HIDALGO COUNTY REMOTE OPERATIONS CENTER PRECINCT 1



SITE PLAN/LOCATION MAP

MILNET ARCHITECTURAL SERVICES
AMERICAN INSTITUTE OF ARCHITECTS

REGISTERED ARCHITECT RUDY MOLINA JR. 34740 STATE OF TEXAS

10/15/2024

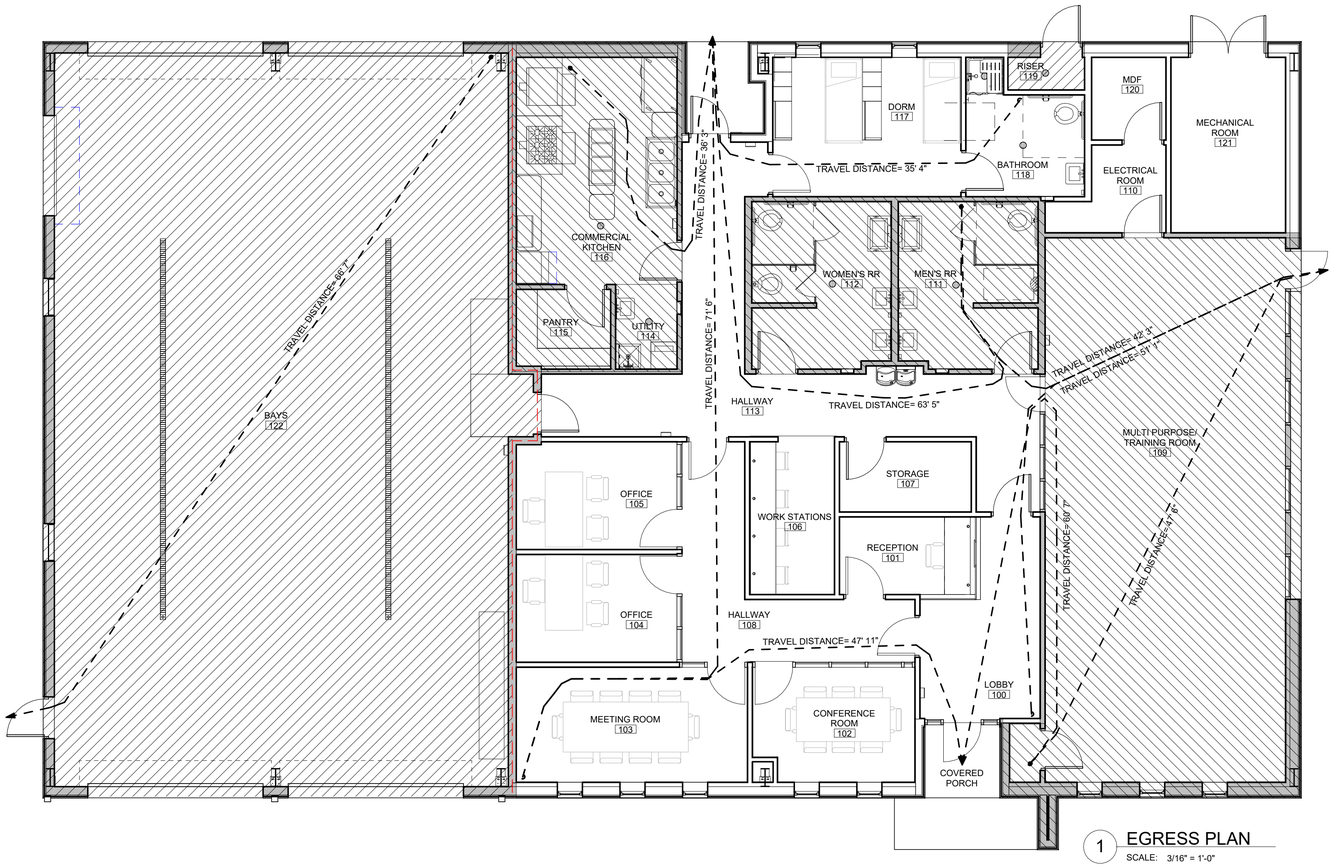
HIDALGO COUNTY REMOTE OPERATIONS CENTER PRECINCT 1
THE COUNTY OF HIDALGO
708 E. EDINGBURG AVE. ELSA, TX 78543

PROJECT NUMBER
224003

DATE
10/15/2024

CONSTRUCTION SET

SHEET NUMBER
A0.0



1 EGRESS PLAN
SCALE: 3/16" = 1'-0"

GENERAL NOTES:

1. OCCUPANT LOAD SIGNS SHALL BE POSTED IN ANY ROOM WITH AN OCCUPANT LOAD OVER 50
2. PROVIDE PANIC HARDWARE FOR GROUP "A" OCCUPANCIES WITH AN OCCUPANT LOAD OF 50 OR MORE.
3. ALL FIRE AND SMOKE STOP RATED PARTITIONS MUST BE MARKED WITH 2.5" MIN. RED LETTERING ABOVE CEILING AS FOLLOWS: "FIRE AND SMOKE BARRIER - PROTECT ALL OPENINGS"
4. DOOR EXITING TO BAY MUST BE A 40MIN FIRE RATED DOOR.

APPLICABLE CODES:

INTERNATIONAL BUILDING CODE 2018
2012 TEXAS ACCESSIBILITY STANDARDS
INTERNATIONAL MECHANICAL CODE 2018
INTERNATIONAL PLUMBING CODE 2018
2015 NATIONAL ELECTRICAL CODE
INTERNATIONAL ENERGY CODE 2018
INTERNATIONAL FIRE CODE 2018

CODE SUMMARY

ASSEMBLY
AREA GROSS ..... 1,634 S. F.
OCCUPACY CLASSIFICATION ..... GROUP "A-3"
CONSTRUCTION TYPE II B - UNPROTECTED, SPRINKLERED

BUSINESS
AREA GROSS ..... 2,023 S. F.
OCCUPACY CLASSIFICATION ..... GROUP "B"
CONSTRUCTION TYPE II B - UNPROTECTED, SPRINKLERED

UTILITY
AREA GROSS ..... 2,293 S. F.

TOTAL AREA GROSS ..... 5,950 S. F.

COVERED PORCH ..... 75 S. F.

DORMITORIES OCCUPANCY
167 SQFT. NET USABLE @ 50 SQFT. PER OCCUPANT.....3 OCCUPANTS

OFFICE OCCUPANCY
505 SQFT. NET USABLE @ 100 SQFT. PER OCCUPANT.....5 OCCUPANTS

PARKING GARAGE OCCUPANCY
2133 SQFT. NET USABLE @ 200 SQFT. PER OCCUPANT....11 OCCUPANTS
TOTAL : 19 OCCUPANTS

PLUMBING FACILITIES

	DORMITORIES & OFFICE FOR 8 OCCUPANTS REQUIRED	PARKING GARAGE FOR 11 OCCUPANTS REQUIRED	HAVE
WATER CLOSETS	1/25 -> 1/8	1/100 -> 1/11	4 W/C & 1 URINAL
LAVATORIES	1/40 -> 1/8	1/100 -> 1/11	
DRINKING FOUNTAIN	1/100 -> 1/8	1/1000 -> 1/11	
OTHER	1 SERVICE SINK	1 SERVICE SINK	

EGRESS WIDTH PER OCCUPANT SERVED

	REQUIRED
0.15" PER OCCUPANT	19 * 0.15" = 2.85"

OCCUPANCY LEGEND

BUSINESS & ANCILLIARY AMENITIES

ASSEMBLY

UTILITY

CODE PLAN LEGEND

LINE TYPE INDICATES: 2-HOUR FIRE RATED PARTITION WITH DAMPERS, 1/3 HOUR DOOR RATED ASSEMBLY

LINE TYPE INDICATES: EMERGENCY EXIT PATH OF TRAVEL

PARKING SPACES

22 TOTAL PARKING SPACES
1 A.D.A PARKING SPACE

MILNET
ARCHITECTURAL
SERVICES
AMERICAN INSTITUTE OF ARCHITECTS

REGISTERED ARCHITECT
MICHAEL A. MILNET JR.
74740
STATE OF TEXAS

10/15/2024

HIDALGO COUNTY REMOTE OPERATIONS CENTER PRECINCT 1

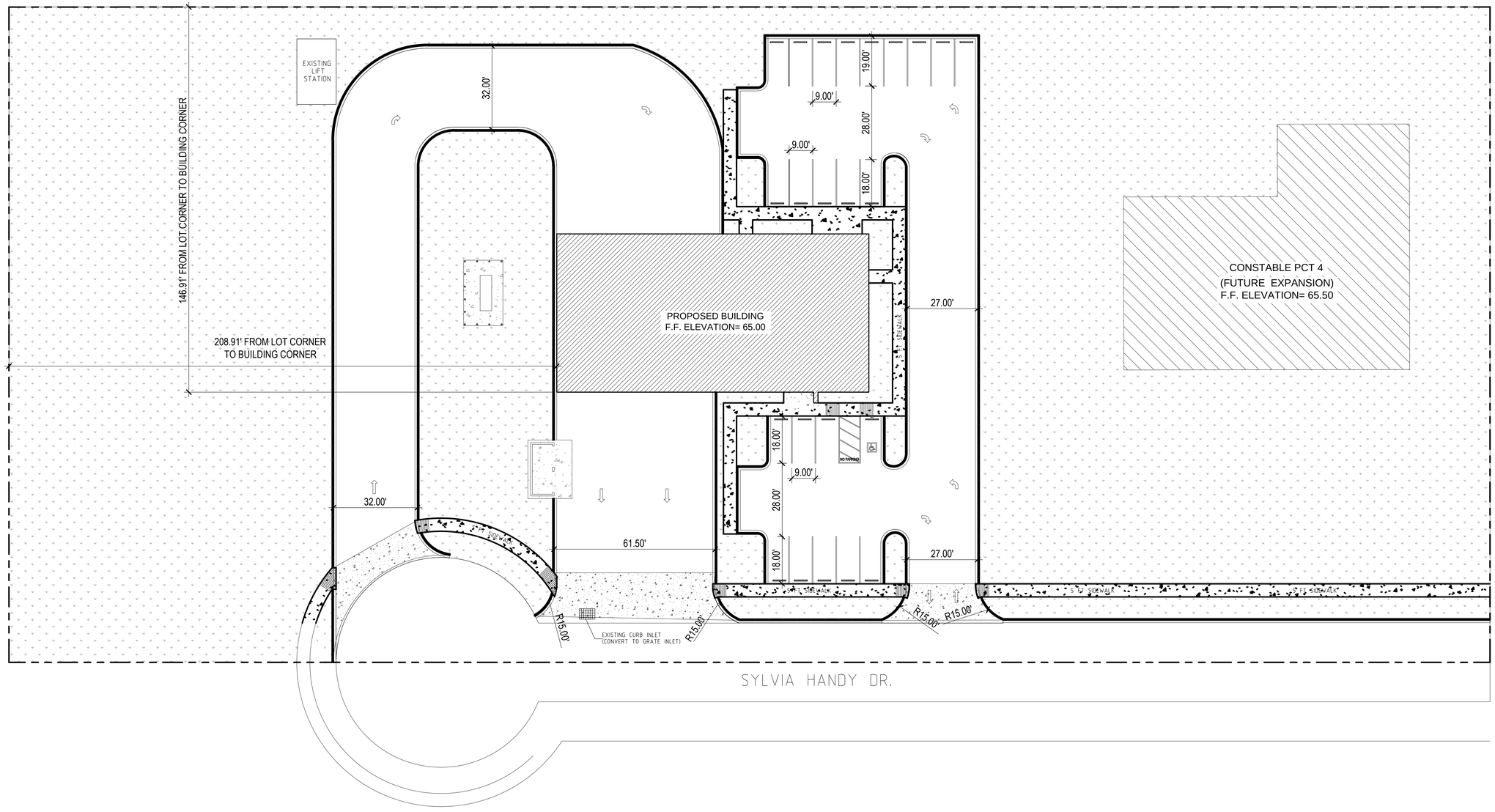
THE COUNTY OF HIDALGO
708 E. EDINGBURG AVE.
ELSA, TX 78543

PROJECT NUMBER
224003

DATE
10/15/2024

CONSTRUCTION SET

SHEET NUMBER
G2.0



NORTH

1 HORIZONTAL & VERTICAL CONTROL PLAN

SCALE: 1"=20'

10-8-24
STATE OF TEXAS
C. HINOJOSA, JR.
90636
LICENSED
PROFESSIONAL ENGINEER

CHLH
ENGINEERING, LLC
TBPE FIRM No. F-8719
701 S. 15th STREET McALLEN, TX. 78501
(956) 687-5560 (956) 687-5561 FAX

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HIDALGO COUNTY REMOTE OPERATIONS CENTER

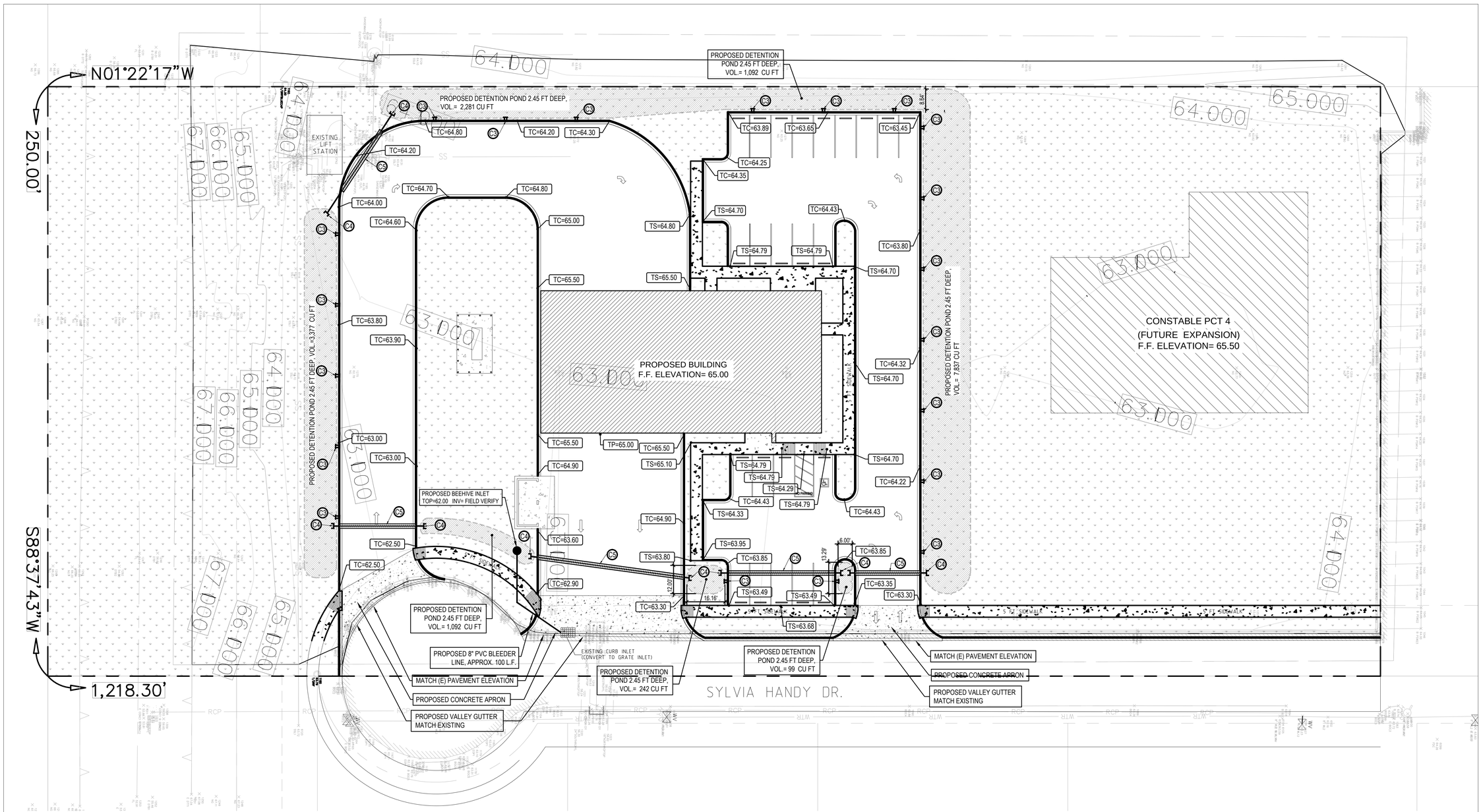
ELSA TEXAS

PROJECT NUMBER
221027

DATE

ISSUE FOR BIDDING

SHEET NUMBER
C1.0



GRADING NOTES:

1. ALL MATERIALS AND CONSTRUCTION SHALL CONFORM TO THE CITY OF ELSA PLANS AND SPECIFICATIONS, EXCEPT AS NOTED HEREIN AND APPROVED BY THE CITY.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING TRENCH SAFETY REQUIREMENTS IN ACCORDANCE WITH CITY STANDARDS, TEXAS LAW, AND O.S.H.A. STANDARDS FOR ALL EXCAVATION IN EXCESS OF FIVE FEET IN DEPTH.
3. THE LOCATION OF ALL UTILITIES LOCATED ON THESE PLANS ARE TAKEN FROM EXISTING PUBLIC RECORDS. THE EXACT LOCATION AND ELEVATION OF ALL PUBLIC UTILITIES MUST BE DETERMINED BY THE CONTRACTOR. IT SHALL BE THE DUTY OF THE CONTRACTOR TO ASCERTAIN WHETHER ANY ADDITIONAL FACILITIES OTHER THAN THOSE SHOWN ON THE PLANS MAY BE PRESENT.
4. IT WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PROTECT ALL PUBLIC UTILITIES IN THE CONSTRUCTION OF THIS PROJECT. ALL MANHOLES, CLEAN-OUTS, VALVE BOXES, FIRE HYDRANTS, ETC. MUST BE ADJUSTED TO PROPER LINE AND GRADE BY THE CONTRACTOR PRIOR TO AND AFTER THE PLACING OF PERMANENT PAVING. UTILITIES MUST BE MAINTAINED TO PROPER LINE AND GRADE CONSTRUCTION OF THE PAVING FOR THIS DEVELOPMENT.
5. DRAINAGE SHOULD BE MAINTAINED AWAY FROM THE FOUNDATIONS, BOTH DURING AND AFTER CONSTRUCTION.
6. BACKFILL FOR UTILITY LINES SHOULD BE CAREFULLY PLACED SO THAT THEY WILL BE STABLE. WHERE UTILITY LINES PASS THROUGH THE PARKING LOT, THE TOP 6" SHOULD BE COMPACTED SIMILARLY TO THE REMAINDER OF THE LOT. UTILITY DITCHES SHOULD BE VISUALLY INSPECTED DURING THE EXCAVATION PROCESS TO ENSURE THE UNDESIRABLE FILL IS NOT USED.
7. ALL EARTHWORK OPERATIONS SHALL CONFORM TO THE RECOMMENDATIONS PER THE GEOTECHNICAL REPORT.
8. ALL PROPOSED SPOT SHOTS ARE GUTTER/TOP OF PAVEMENT/ FINISHED GRADE ELEVATIONS UNLESS OTHERWISE SPECIFIED.

NOTES:

1. CONTRACTOR SHALL FILL TO GRADE ALL AREAS BETWEEN CURBS, SIDEWALKS, BUILDING.
2. CONTRACTOR SHALL INSTALL IRRIGATION SLEEVES (4" SCH 80) AS SHOWN. COORDINATE WITH LANDSCAPE PLAN FOR ADDITIONAL INFORMATION.
3. CONTRACTOR SHALL MAINTAIN 2% OR LESS AT HANDICAP ACCESSIBLE PARKING AREAS.
4. CONTRACTOR SHALL PREPARE SITE AND REMOVE ANY EXISTING ASPHALT/CONCRETE WITHIN PROJECT LIMITS TO COMPLETE CONSTRUCTION.
5. EXPANSION JOINTS & CONSTRUCTION JOINTS NOT TO EXCEED 20' ON CENTER TO EACH DIRECTION.
6. HAND RAILS AT STEPS & RAMPS PER ARCH'L DRAWINGS.
7. 5' SIDEWALK SHALL BE PLACED AT A MINIMUM OF 3' BEHIND EXISTING CURB WITHIN THE COMMON ACCESS EASEMENT. IF SPACING DOES NOT ALLOW ENOUGH CLEARANCE TO BUILD THE WALK WITHIN THE COMMON ACCESS EASEMENTS, THEN THE WALK WILL BE RESIZED TO 5' WIDTH AND BE PLACED DIRECTLY BEHIND THE COMMON ACCESS CURB & GUTTER.

LEGEND:

TS=100.00	PROPOSED TOP OF SIDEWALK
TP=100.00	PROPOSED TOP OF PAVEMENT
TC=100.00	PROPOSED TOP OF CURB
(TS=100.00)	EXISTING TOP OF SIDEWALK
(TC=100.00)	EXISTING TOP OF CURB
(TP=100.00)	EXISTING TOP OF PAVEMENT
(100.00)	EXISTING ELEVATION
C1	PROP. HANDICAP RAMP
C2	PROP. SIDEWALK OPENING
C3	PROP. 12" CURB OPENING
C4	PROP. 8" PVC EQUALIZER w/ S.E.T. ON EACH SIDE.
C5	PROP. 16" STEEL CASING
	PROPOSED DIRECTION OF RUNOFF

NORTH

1 PAVING & DRAINAGE PLAN
SCALE: 1"=20'

10-8-24
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ELSA TEXAS

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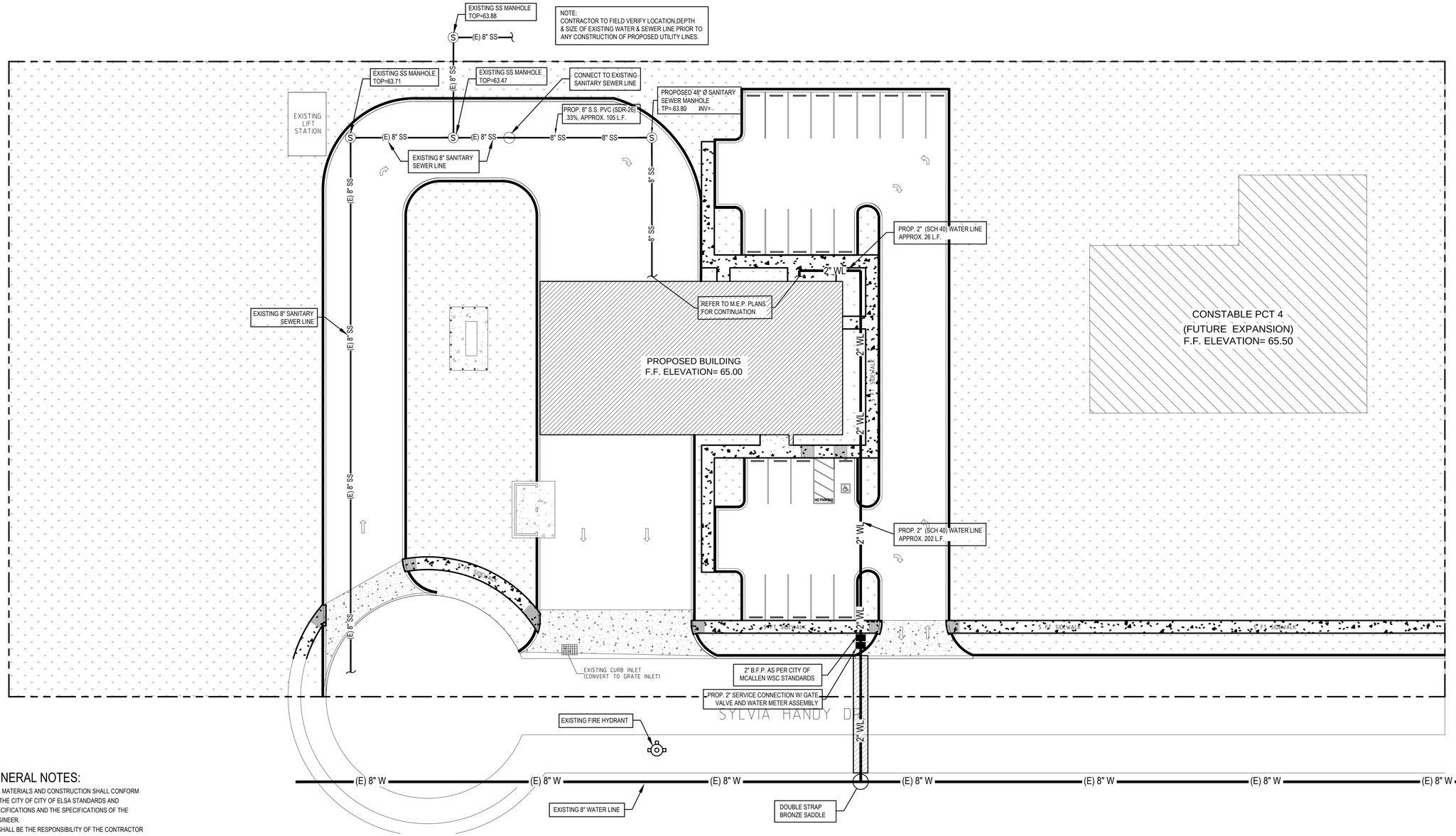

GENERAL NOTES:

1. ALL MATERIALS AND CONSTRUCTION SHALL CONFORM TO THE CITY OF CITY OF ELSA STANDARDS AND SPECIFICATIONS AND THE SPECIFICATIONS OF THE ENGINEER.
2. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PROTECT ALL PUBLIC UTILITIES IN THE CONSTRUCTION OF THIS PROJECT. ALL MANHOLES, CLEANOUTS, VALVE BOXES, FIRE HYDRANTS, ETC... MUST BE ADJUSTED TO PROPER LINE AND GRADE BY THE CONTRACTOR PRIOR TO AND AFTER THE PLACING OF PERMANENT PAVING. UTILITIES MUST BE MAINTAINED TO PROPER LINE AND GRADE DURING CONSTRUCTION OF OF THIS PROJECT.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING WITH ALL THE APPROPRIATE UTILITY COMPANIES FOR THE LOCATION OF ALL UTILITIES WITHIN THE CONSTRUCTION AREA.
4. THE PREPARATION OF THESE PLANS REFLECTS INFORMATION, PROVIDED BY OTHERS, ON THE APPROXIMATE LOCATION AND EXISTENCE OF EXISTING UTILITIES AND ADJACENT PHYSICAL FEATURES: HOWEVER, THEY DO NOT IMPLY OR AFFIRM THAT ALL UTILITIES OR PHYSICAL FEATURES ARE SHOWN. GENERALLY, UTILITY SERVICE CONNECTIONS ARE NOT INDICATED ON THESE PLANS. CONTRACTOR IS RESPONSIBLE FOR NOTIFICATION OF THE OWNER IMMEDIATELY UPON ENCOUNTERING UNFORESEEN CONFLICTS.
5. THE APPROXIMATE LOCATIONS OF KNOWN EXISTING UTILITIES ARE SHOWN. CONTRACTOR SHALL DETERMINE THE EXACT HORIZONTAL AND VERTICAL LOCATIONS IN THE FIELD PRIOR TO COMMENCING WORK. CONTRACTOR TO BE FULLY RESPONSIBLE FOR DAMAGES WHICH MIGHT OCCUR BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE EXISTING UTILITIES.
6. THE HARDSCAPE CONTRACTOR SHALL COORDINATE WITH THE UTILITY CONTRACTOR TO INSURE ALL SLEEVING FOR IRRIGATION HAS BEEN INSTALLED PRIOR TO PLACEMENT OF HARDSCAPE.
7. ALL HARDSCAPE AND EARTHWORK OPERATIONS SHALL CONFORM TO THE RECOMMENDATIONS PER THE GEOTECHNICAL REPORT.
8. ALL WATER LINES, 6" AND ABOVE SHALL BE AWWA C909 CLASS 150 PSI.
9. EXTEND WATER DEADHEADS AND SANITARY SEWER LATERALS 2 FEET BEYOND PROPOSED CURBS OR AS INDICATED.
10. MAXIMUM TRENCH WIDTH FOR ALL PIPE THROUGH 12" DIA. SHALL BE 32".
11. CONTRACTOR TO DESIGN AND INSTALL THRUST BLOCKS AT ALL BENDS IN WATERLINE.
12. SEWER LINES SHALL BE SDR-35.
13. FIRE HYDRANT AND WATER VALVE MUST BE MUELLER.
14. ALL CAST IRON FITTINGS MUST BE WRAPPED IN PLASTIC.
15. FIRE SPRINKLER SERVICE LINE SHALL BE SIZED AND INSTALLED BY A STATE LICENSED FIRE SPRINKLER CONTRACTOR.
16. A STATE-LICENSED SPRINKLER CONTRACTOR SHALL SUBMIT PLANS AND OBTAIN A PERMIT FORM THE FIRE DEPARTMENT PRIOR TO THE INSTALLATION OF THE SPRINKLER SYSTEM.
17. FDC MUST BE WITHIN 100' OF PROPOSED FIRE HYDRANT.

NOTES:

1. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO LOCATE UNDERGROUND UTILITIES, WHETHER SHOWN OR NOT SHOWN ON THE DRAWINGS, SUFFICIENTLY IN ADVANCE OF OPERATION TO PRECLUDE DAMAGE TO SAME.
2. IN THE EVENT OF DAMAGE TO UNDERGROUND FACILITIES, WHETHER SHOWN OR NOT SHOWN IN THE DRAWINGS, THE CONTRACTOR SHALL MAKE THE NECESSARY REPAIRS TO PLACE THE FACILITIES BACK IN SERVICE AT NO INCREASE IN THE CONTRACTOR'S PRICE, AND ALL SUCH REPAIRS SHALL CONFORM TO THE REQUIREMENTS OF THE COMPANY OR AGENCY SERVICING THE FACILITY.
3. THE CONTRACTOR SHALL EXERCISE EXTRA CARE TO PREVENT DAMAGE TO ALL OTHER STRUCTURES IN THE AREA INCLUDING BUILDINGS, FENCES, ROADS, PIPELINES, UTILITIES, ETC., WHETHER PUBLICLY OR PRIVATELY OWNED.
4. UNTIL ACCEPTANCE BY THE ENGINEER OF ANY PART OR ALL OF THE CONSTRUCTION, AS PROVIDED FOR IN THE PLANS AND SPECIFICATIONS, IT SHALL BE UNDER THE CHARGE AND CARE OF THE CONTRACTOR, AND HE SHALL TAKE EVERY NECESSARY PRECAUTION AGAINST INJURY OR DAMAGE TO ANY PART OF THE WORK. THE CONTRACTOR SHALL REBUILD REPAIRS, RESTORE AND MAKE GOOD, AT HIS OWN EXPENSE, ALL INJURIES OR DAMAGE TO ANY PORTION OF THE WORK BEFORE ITS COMPLETION AND ACCEPTANCE.
5. NO OPEN TRENCHES OF EXCAVATION SHALL BE LEFT OPEN OVERNIGHT.
6. COORDINATE ALL UTILITY WORK WITH TEXAS GAS SERVICE FOR ACCURATE DETERMINATION AND IDENTIFICATION OF ALL GAS LINES, WHETHER SHOWN OR NOT SHOWN ON THE DRAWINGS, SUFFICIENTLY IN ADVANCE OF OPERATION TO PRECLUDE DAMAGE TO SAME.
7. ALL WATERLINE TAPS AND WATERMETERS SHALL BE INSTALLED BY CONTRACTOR AT CONTRACTOR'S EXPENSE. COORDINATE BEFORE COMMENCING ANY UTILITY WORK.
8. COORDINATE ALL UTILITY WORK WITH PLUMBING PLANS BEFORE COMMENCING ANY UTILITY WORK. REFER TO PLUMBING PLANS FOR CONTINUATION.
9. ENCASE ALL WATERLINE WHERE CROSSING SANITARY SEWER LINES. KEEP A MINIMUM 2 (TWO) FEET SEPARATION BETWEEN WATER AND SEWER LINES.
10. COORDINATE WITH GRADING PLAN FOR TOP OF MANHOLES AND CLEANOUTS. ADJUST AS NEEDED.
11. FDC MUST BE WITHIN 100' OF PROPOSED FIRE HYDRANT.

NORTH

1 UTILITIES PLAN
SCALE: 1"=20'

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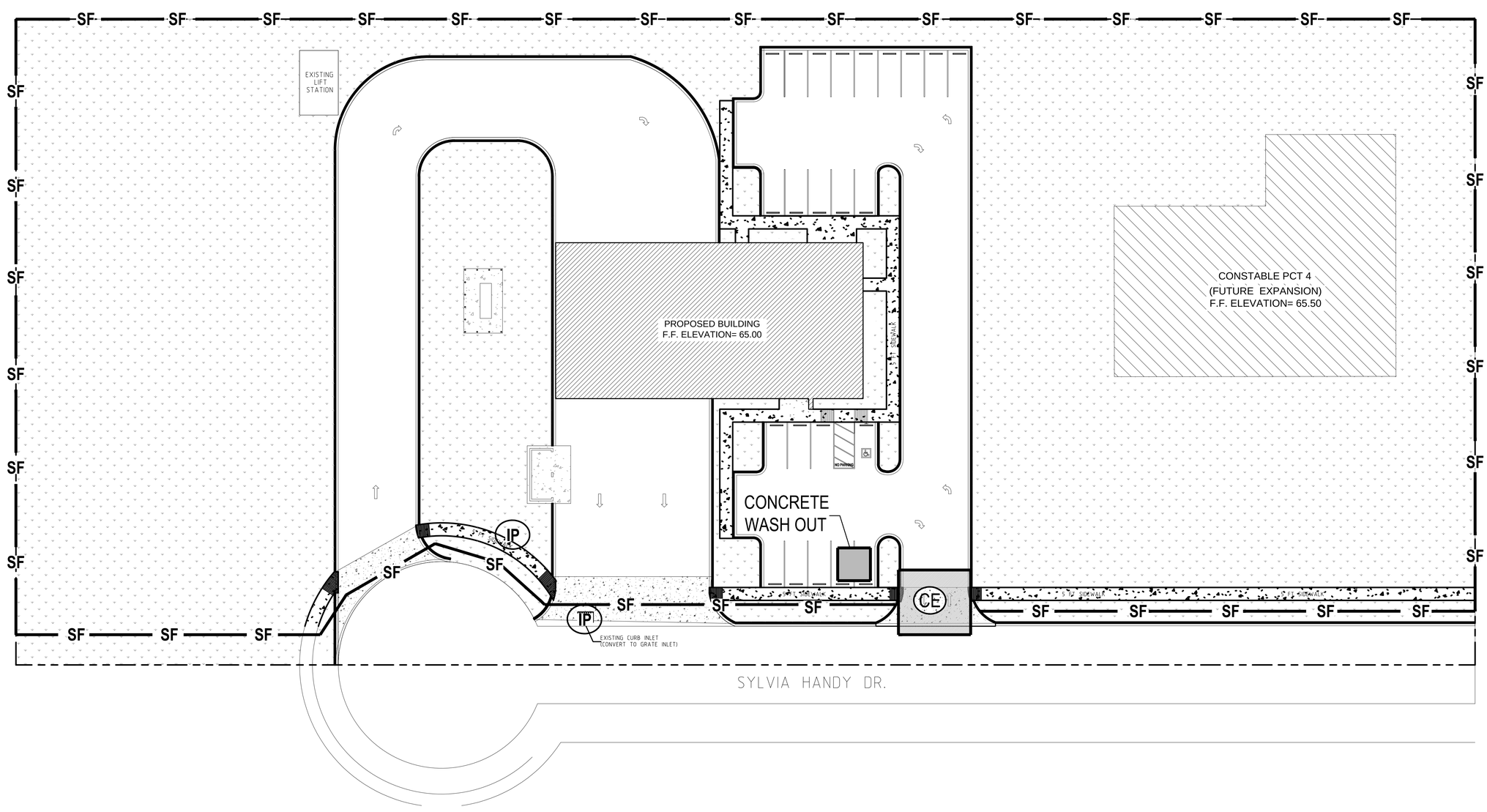

LEGEND:

SF SEDIMENT CONTROL SILT FENCE

(CE) CONSTRUCTION ENTRANCE

(IP) INLET PROTECTION

NORTH

1 EROSION & SEDIMENT CONTROL PLAN

SCALE: 1"=20'

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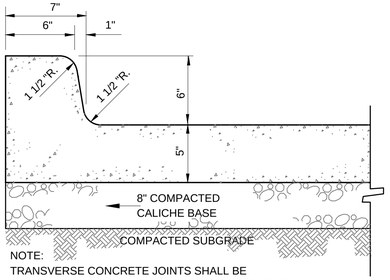
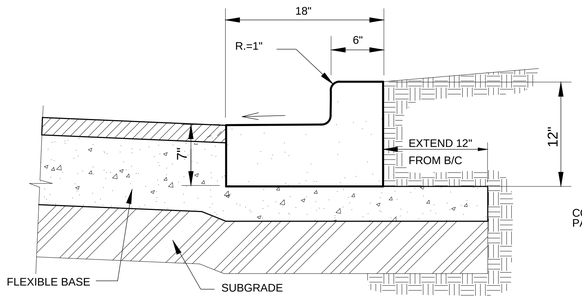
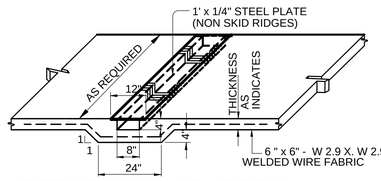


NOTE:
TRANSVERSE CONCRETE JOINTS SHALL BE CONSTRUCTED THROUGH TO BACK OF ALL CURBS

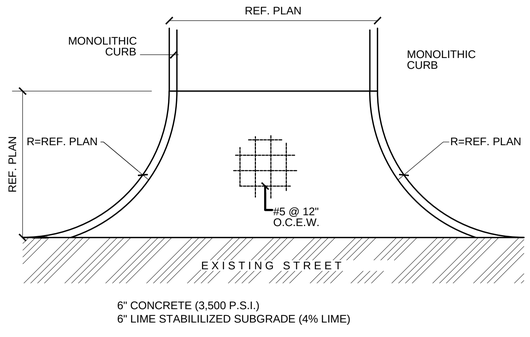
INTEGRAL CURB



SPILLWAY CONCRETE CURB & GUTTER

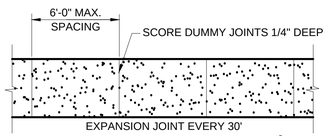


SIDEWALK DRAINAGE OPENING

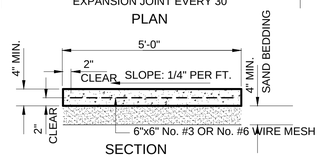


6" CONCRETE (3,500 P.S.I.)
6" LIME STABILILIZED SUBGRADE (4% LIME)

CONCRETE APRON DETAIL



PLAN

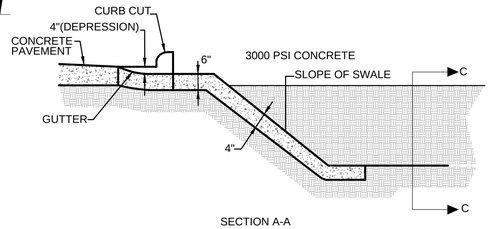


SECTION

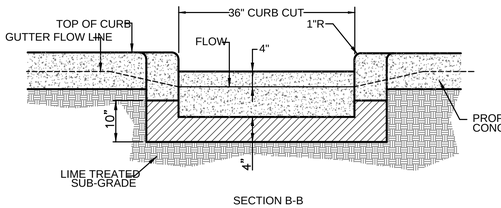
SIDEWALK NOTES:

1. MINIMUM 5'-0" WIDE SIDEWALK.
2. SIDEWALK CONCRETE SHALL BE 5 SACK CEMENT MIX AND SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3000 psi.
3. CONTRACTOR SHALL COMPLY WITH LATEST REGULATIONS AS SET FORTH IN AMERICANS WITH DISABILITIES ACT (ADA).
4. SIDEWALK GRADIENT SHALL NOT EXCEED 1:20.
5. CONTRACTOR SHALL VERIFY EXISTENCE AND LOCATION OF EXISTING SIDEWALKS ON TOP OF LINES.

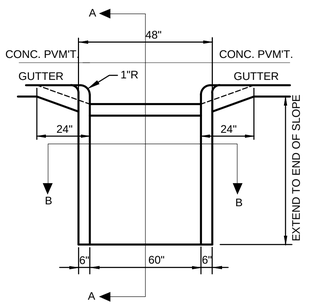
CONC. SIDEWALK DETAIL



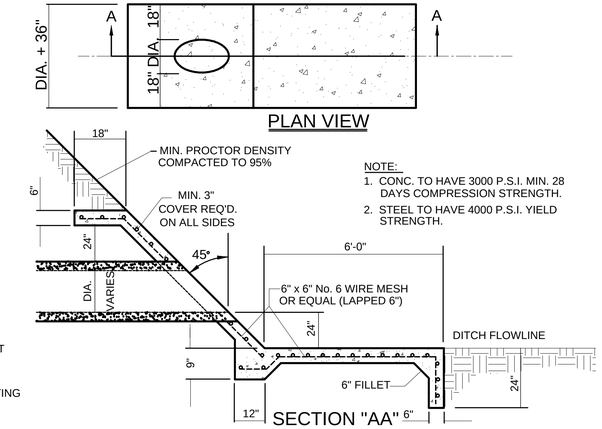
SECTION A-A



SECTION B-B



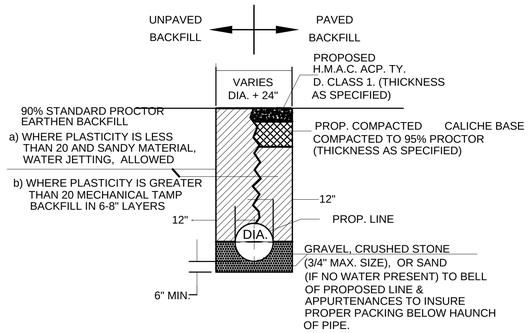
TYP. CURB OPENING w/ SPILLWAY DETAIL



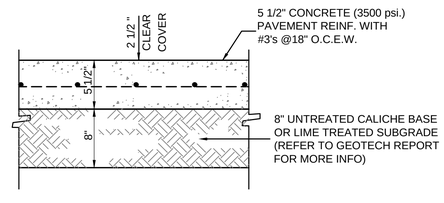
PLAN VIEW

NOTE:
1. CONC. TO HAVE 3000 P.S.I. MIN. 28 DAYS COMPRESSION STRENGTH.
2. STEEL TO HAVE 4000 P.S.I. YIELD STRENGTH.

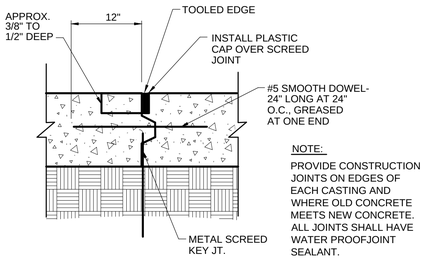
STORM DISCHARGE STRUCTURE



PIPE BEDDING DETAILS

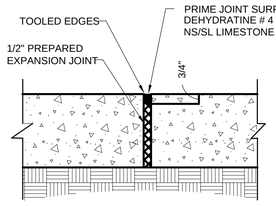


CONCRETE PAVEMENT SECTION



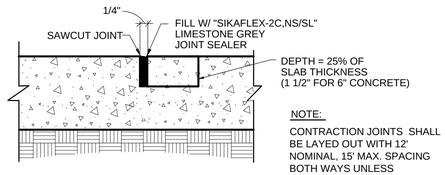
NOTE:
PROVIDE CONSTRUCTION JOINTS ON EDGES OF EACH CASTING AND WHERE OLD CONCRETE MEETS NEW CONCRETE. ALL JOINTS SHALL HAVE WATER PROOFJOINT SEALANT.

CONSTRUCTION JOINT "CJ"



NOTE:
PROVIDE EXPANSION JOINTS AT BUILDING AND PROPERTY LINES. ON PERIMETER OF PEDESTALS, ISLANDS, PADS, UNDERGROUND TANKS. ALL JOINTS SHALL HAVE WATER PROOFJOINT SEALANT.

EXPANSION JOINT "EJ"

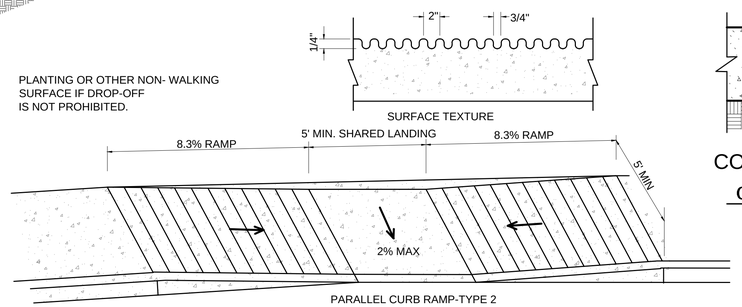


NOTE:
CONTRACTION JOINTS SHALL BE LAYED OUT WITH 12' NOMINAL, 15' MAX. SPACING BOTH WAYS UNLESS OTHERWISE SHOWN. ALL JOINTS SHALL HAVE JOINT SEALANT.

CONTRACTION JOINT "SC"

CONCRETE JOINT DETAIL

PLANTING OR OTHER NON- WALKING SURFACE IF DROP-OFF IS NOT PROHIBITED.



PARALLEL CURB RAMP-TYPE 2

GENERAL NOTES:
1. WHEELCHAIR RAMPS ARE TO BE LOCATED AT CROSSWALK AREAS DESIGNATED ON THE PLAN.
2. SURFACE TEXTURE OF WHEELCHAIR RAMP SHALL BE OBTAINED BY TOOL FINISH TRAVERSE TO THE SLOPE OF THE RAMP.
3. SLOPES SHALL BE UNIFORM WITH NO ABRUPT CHANGES IN GRADES, NORMAL GUTTER LINE PROFILE SHOULD BE MAINTAINED THROUGH THE AREA OF THE RAMP.
4. WHEELCHAIR RAMPS SHALL BE MEASURED AND PAINTED AS CONCRETE SIDEWALK AND CONCRETE CURB AND GUTTER, AS APPLICABLE.
5. CONCRETE RAMP SHALL BE 5 SACK MIX AND SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3000 P.S.I.
6. ALL CONCRETE WORK SHALL BE TREATED WITH THE MEMBRANE CURING COMPOUND AFTER SURFACE TEXTURE HAS BEEN COMPLETED.
7. 6" X 6" NO. 6 WIRE MESH SHALL BE USED FOR REINFORCING.
8. ALL RAMPS SHALL CONTRAST VISUALLY WITH ADJOINING SURFACES, DARK VERSUS LIGHT. THE MATERIAL USED TO PROVIDE THE CONTRAST SHALL BE AN INTEGRAL PART OF THE RAMP.

SIDEWALK RAMP

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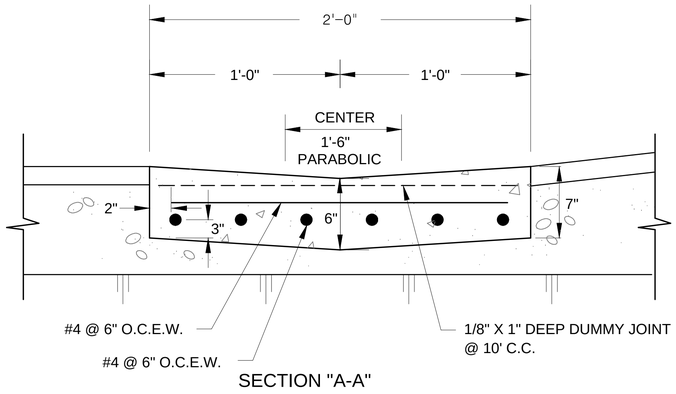
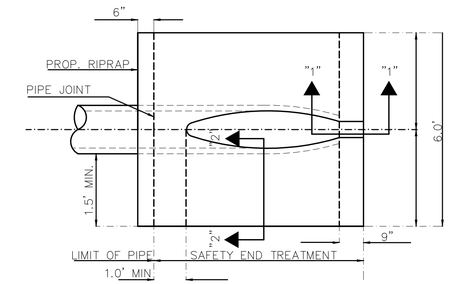
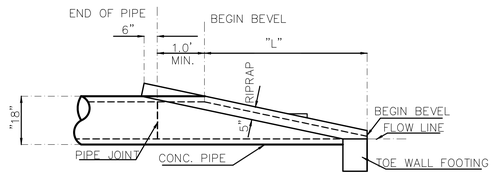


SECTION "A-A"

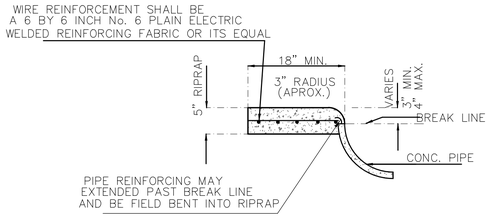
CONCRETE VALLEY GUTTER



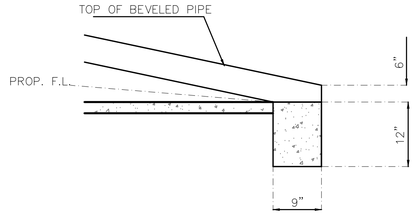
PLAN VIEW



ELEVATION



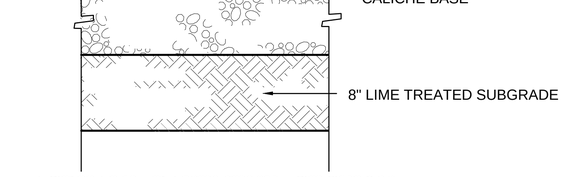
SECTION "2" – "2"



SECTION "1" – "1"

PIPE DIA. (IN.)	"L"			
	3:1	4:1	5:1	6:1
15"	2'–9"	3'–8"	4'–7"	5'–8"
18"	3'–6"	4'–8"	5'–10"	7'–0"
24"	5'–4"	6'–10"	8'–6"	10'–8"
30"	6'–10"	9'–4"	11'–6"	13'–7"

SAFETY END TREATMENT



ASPHALT PAVEMENT SECTION

GENERAL NOTES:

1. At paving and sidewalk areas, contractor must remove all vegetation and a minimum of 6" of topsoil. This topsoil may be stock-piled and used for fill in landscape and lawn areas.
2. Select fill under proposed pavement shall have a plasticity index ranging from 5% to 17%.
3. All subgrade shall be treated with 3.5% hydratated lime as per specifications.
4. All sidewalks shall have a minimum slope of 1/4" per foot.
5. All gutters shall have a minimum slope of 0.2%. Unless otherwise noted on the plans.
6. Contractor to provide expansion joints between building and new concrete pavement or sidewalk.
7. All required select fill to be placed in 6" lifts with compaction to 95% proctor or as indicated by the geotechnical engineer.
8. All curb and gutter to be backfilled and stabilized as required.
9. Contractor to provide positive drainage away from building and into drainage system.
10. Construction pad to be grated as required to facilitate drainage run-off from construction site. Silt Fence And/Or Silt Traps Shall Be Provided Before Discharge Of Run-Off From Construction Site To Street Drainage. Contractor shall be responsible for compliance with Federal, state, & local permits regarding storm water pollution prevention.
11. If anything conflicts with the proposed building an/or site improvements, contractor must remove, dispose of, or relocate at the contractors expense.
12. Handicap signage to conform with federal regulations (A.D.A.).
13. Contractor to provide all construction staking for building and site improvements.
14. Contractor to grade swales as required from sidewalk drainage openings, fire lanes, culverts and curb slots to inlets.
15. Contractor shall be familiar with special construction requirements while working within the limits of City of Elsa, Texas.;
16. All excavation and trenching operations shall be conducted in accordance with all safety osha publication 2226 and as required in house bill 662 passed by the Texas legislature.
17. Contractor to notify all utility companies 48 hours prior to construction of any site improvements for location of gas lines, telephone lines, television cables, water lines and sewer lines.
18. Contractor to match transition of new pavement to existing pavement as proposed by engineer.
19. Contractor to include all striping for project.
20. Contractor to verify horizontal and vertical location of existing utilities which may conflict with proposed alignment of new facilities.
21. Contractor shall provide Erosion and Sediment Control permits.

SITE PLAN NOTES:

1. All work and materials shall comply with all city, county, state federal and osha regulations.
2. Contractor shall refer to the architectural plans for exact locations and dimensions of vestibules, slope paving, ramps, sidewalks, exit porches, precise building dimensions, exact building utility entrance locations, and total number, location, and size of downspouts.
3. All disturbed areas are to receive four inches of topsoil, seed, mulch, and water until a healthy stand grass is established.
4. All islands with curb & gutter shall be landscaped. Those islands are to have 18" curb & gutter. All remaining islands are to be stripped as shown.
5. All dimensions and radious are to the back of curb, edge of pavement, center of stripe or object or face of building unless otherwise noted.
6. Existing structures within construction limits that are to be abandoned, removed or relocated, shall be done in a proper manner offsite, as necessary. All cost shall be included in base bid.
7. Contractor shall be responsible for all relocations, including but not limited to all utilities, storm drainage, signs, traffic signals & poles, etc. as required. All work shall be done in accordance with governing authorities specifications and shall be approved by such. All cost shall be included in base bid.
8. The site work for this project shall meet or exceed "The city of Elsa standard site work specifications".
9. Contractor is responsible for protection and replacement of property corners.
10. Contractor shall match existing curb & gutter in grade, size, type and alignment where applicable.
11. Contractor shall be responsible for repairs to damage of any existing improvements during construction, such as but not limited to drainage utilities, pavement, stripping, curb etc. Repairs shall be equal to or better than existing.

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HIDALGO COUNTY REMOTE OPERATIONS CENTER

ELSA TEXAS

PROJECT NUMBER
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DATE

ISSUE FOR BIDDING

SHEET NUMBER
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10-8-24
STATE OF TEXAS
C. HINOJOSA, JR.
90636
LICENSED
PROFESSIONAL ENGINEER

CHLH
ENGINEERING, LLC
TBPE FIRM No. F-8719
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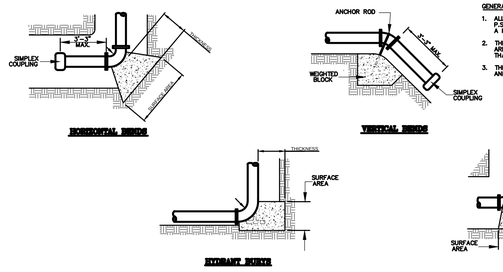
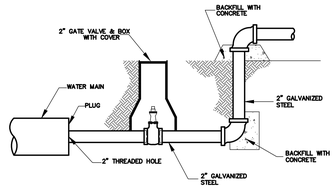


GENERAL NOTES :

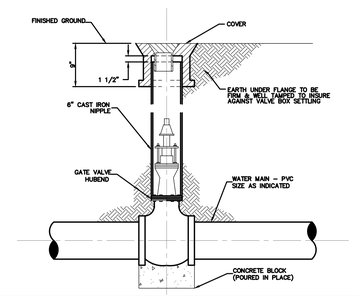
1. ALL VALVES SHOWN ARE MINIMUM FOR A HYDROSTATIC PRESSURE OF 150 P.S.I. AND A SOIL RESISTANCE OF 2,000 LBS./SQ.FT WITH PIPELINE HAVING A MINIMUM OF 30" OF COVER.
2. THE CONTRACTOR SHALL CONSIDER REDUCTIONS OF THRUST BLOCK SURFACE AREA UPON SUBMITTAL OF APPROVED SOIL RESISTANT TEST RESULTS GREATER THAN 2000 LBS./SQ.FT.
3. THE LOCATION OF THRUST BLOCKS DEPENDS UPON THE DIRECTION OF THRUST AND TYPE OF FITTINGS.

THRUST BLOCK SIZE			
DIAMETER OF PIPE INCHES	HORIZONTAL BEND SURFACE AREA SQ. FT.	THICKNESS INCHES	WEIGHT AT VERTICAL BENDS – lbs.
22½ 1/8 BENDS			
6 OR LESS	2	8	1,700
8	3	12	2,600
10	4.5	12	3,900
12	5	18	5,600
14	6	18	7,600
16	8	18	10,000
45°BENDS			
6 OR LESS	4	12	3,200
8	5	14	4,800
10	6	18	7,000
12	7	18	13,000
14	10	24	17,000
16	11.5	24	23,000
90°BENDS			
6 OR LESS	6	12	6,000
8	8	12	10,700
10	10	18	16,700
12	12	18	24,000
14	16	24	32,600
16	18	24	42,700
TEES & DEAD ENDS			
6 OR LESS	3	12	----
8	4	13	----
10	6.5	18	----
12	8.5	18	----
14	11.5	24	----
16	15	24	----

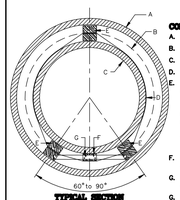
1. TYPICAL THRUST BLOCK DETAIL



2. 2" BLOWOFF DETAIL



3. WATER VALVE & BOX INSTALLATION



TYPICAL SECTION

CONSTRUCTION NOTES :

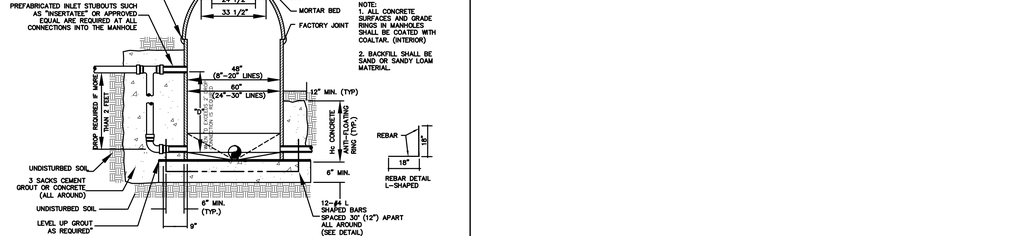
A. WELDING STEEL PIPE CASING.
B. BELL DIA. OF CARRIER PIPE.
C. CARRIER PIPE
D. STAINLESS STEEL STRAPS
E. 3" x 3" x CASING LENGTH REDWOOD OR CEDAR SKID BLOCKS TREATED WITH PENTA–CHLOROPHENOL, TO BE PLACED AT EACH END OF PIPE SECTIONS AND SPACED AROUND PIPE AS SHOWN. BLOCKS ARE STRAPPED TOGETHER WITH STAINLESS STEEL STRAPS. STRAPS, WILL PASS THROUGH BLOCKS.
F. 2" x 4" BLOCK, TREATED REDWOOD OR CEDAR.
G. 1" CLEAT TREATED REDWOOD OR CEDAR.
G. 1" CLEAT TREATED REDWOOD OR CEDAR.
H. ENDS OF CASING TO BE MORTARED.

GENERAL NOTES :

1. METHOD OF END CLOSURE TO BE DESIGNED TO SUIT CONDITIONS.

BORING INSTALLATION	
PIPE CASING SIZE	CARRIER PIPE SIZE
14" SCHEDULE 30	6"
16" SCHEDULE 30	8"
18" STANDARD CLASS	10"
24" STANDARD CLASS	12"
24" SCHEDULE 30	12"
30" SCHEDULE 30	14"
30" 0.375 WALL	16"
36" 0.375 WALL	24"

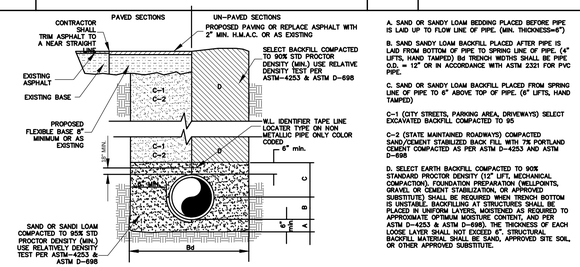
4. BORE AND CASING DETAIL



GENERAL NOTES :

1. CASING REQUIRED ON ALL SERVICES EXTENDING ACROSS RIGHT–OF–WAY.
2. ALL COMPRESSION OR PACK TYPE FITNESS AND JOINTS REQUIRE STAINLESS STEEL INSERTS OF REQUIREDSIZE.
3. WATER SERVICE CONNECTIONS CROSSING A STREET SHALL BE ENCASED IN A 4" P.V.C. SHC40 CASING. LENGTH OF CASING SHALL BE WIDTH OF STREET PLUS 10.0 FEET.

5. TYPICAL WATER SERVICE CONNECTION



A. SAND OR SANDY LOAM BEDDING PLACED BEFORE PIPE IS LAID UP TO FLOW LINE OF PIPE. (MIN. THICKNESS=6")

B. SAND SANDY LOAM BACKFILL PLACED AFTER PIPE IS LAID FROM BOTTOM OF PIPE TO SPRING LINE OF PIPE. (4" LIFTS, HAND TAMPED) Bd TRENCH WIDTHS SHALL BE PIPE O.D. + 12" OR IN ACCORDANCE WITH ASTM 2321 FOR PVC PIPE.

C. SAND OR SANDY LOAM BACKFILL PLACED FROM SPRING LINE OF PIPE TO 6" ABOVE TOP OF PIPE. (6" LIFTS, HAND TAMPED)

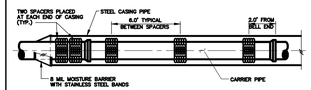
C–1 (CITY STREETS, PARKING AREA, DRIVEWAYS) SELECT EXCAVATED BACKFILL COMPACTED TO 95

C–2 (STATE MAINTAINED ROADWAYS) COMPACTED SAND/CEMENT STABILIZED BACK FILL WITH 7% PORTLAND CEMENT COMPACTED AS PER ASTM D–4253 AND ASTM D–698

D. SELECT EARTH BACKFILL COMPACTED TO 90% STANDARD PROCTOR DENSITY (12" LIFT, MECHANICAL COMPACTION). FOUNDATION PREPARATION (WELLPOINTS, GRAVEL OR CEMENT STABILIZATION, OR APPROVED SUBSTITUTE) SHALL BE REQUIRED WHEN TRENCH BOTTOM IS UNSTABLE. BACKFILLING AT STRUCTURES SHALL BE PLACED IN UNIFORM LAYERS, MOISTENED AS REQUIRED TO APPROXIMATE OPTIMUM MOISTURE CONTENT, AND PER ASTM D–4253 & ASTM D–698). THE THICKNESS OF EACH LOOSE LAYER SHALL NOT EXCEED 6". STRUCTURAL BACKFILL MATERIAL SHALL BE SAND, APPROVED SITE SOIL, OR OTHER APPROVED SUBSTITUTE.

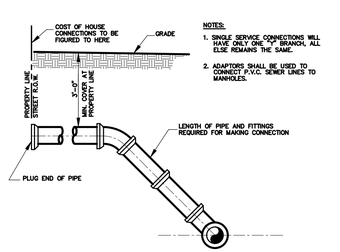
6. WATERLINE BEDDING NOTES DETAIL

BORING INSTALLATION	
PIPE CASING SIZE	CARRIER PIPE SIZE
12" 0.375 WALL	4"–6"
16" 0.375 WALL	8"
18" 0.375 WALL	10"
20" 0.375 WALL	12"
24" 0.375 WALL	14"
26" 0.375 WALL	16"
32" 0.375 WALL	18"
36" 0.375 WALL	20"
40" 0.375 WALL	24"



BORING and CASING DETAIL

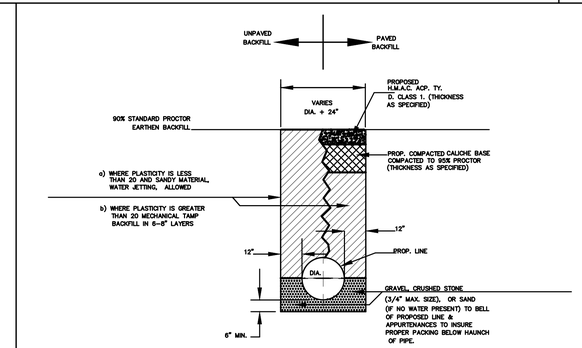
7. BORING AND CASING DETAIL



NOTES:

1. SINGLE SERVICE CONNECTIONS WILL HAVE ONLY ONE "Y" BRANCH, ALL ELSE REMAINS THE SAME.
2. ADAPTORS SHALL BE USED TO CONNECT P.V.C. SEWER LINES TO MANHOLES.

8. SANITARY SEWER SERVICE CONNECTION



9. PIPE BEDDING DETAILS

10. TYPICAL FIBERGLASS MANHOLE

GENERAL NOTES:

1. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO LOCATE UNDERGROUND UTILITIES, WHETHER SHOWN OR NOT SHOWN ON THE DRAWINGS, SUFFICIENTLY IN ADVANCE OF OPERATION TO PRECLUDE DAMAGE TO SAME.
2. IN THE EVENT OF DAMAGE TO UNDERGROUND FACILITIES, WHETHER SHOWN OR NOT SHOWN IN THE DRAWINGS, THE CONTRACTOR SHALL MAKE THE NECESSARY REPAIRS TO PLACE THE FACILITIES BACK IN SERVICE AT NO INCREASE IN THE CONTRACTOR'S PRICE, AND ALL SUCH REPAIRS SHALL CONFORM TO THE REQUIREMENTS OF THE COMPANY OR AGENCY SERVICING THE FACILITY.
3. THE CONTRACTOR SHALL EXERCISE EXTRA CARE TO PREVENT DAMAGE TO ALL OTHER STRUCTURES IN THE AREA INCLUDING BUILDINGS, FENCES, ROADS, PIPELINES, UTILITIES, ETC., WHETHER PUBLICLY OR PRIVATELY OWNED.
4. UNTIL ACCEPTANCE BY THE ENGINEER OF ANY PART OR ALL OF THE CONSTRUCTION, AS PROVIDED FOR IN THE PLANS AND SPECIFICATIONS, IT SHALL BE UNDER THE CHARGE AND CARE OF THE CONTRACTOR, AND HE SHALL TAKE EVERY NECESSARY PRECAUTION AGAINST INJURY OR DAMAGE TO ANY PART OF THE WORK. THE CONTRACTOR SHALL REBUILD REPAIRS, RESTORE AND MAKE GOOD, AT HIS OWN EXPENSE, ALL INJURIES OR DAMAGE TO ANY PORTION OF THE WORK BEFORE ITS COMPLETION AND ACCEPTANCE.
5. NO OPEN TRENCHES OF EXCAVATION SHALL BE LEFT OPEN OVERNIGHT.
6. COORDINATE ALL UTILITY WORK WITH TEXAS GAS FOR ACCURATE DETERMINATION AND IDENTIFICATION OF ALL GAS LINES, WHETHER SHOWN OR NOT SHOWN ON THE DRAWINGS, SUFFICIENTLY IN ADVANCE OF OPERATION TO PRECLUDE DAMAGE TO SAME.

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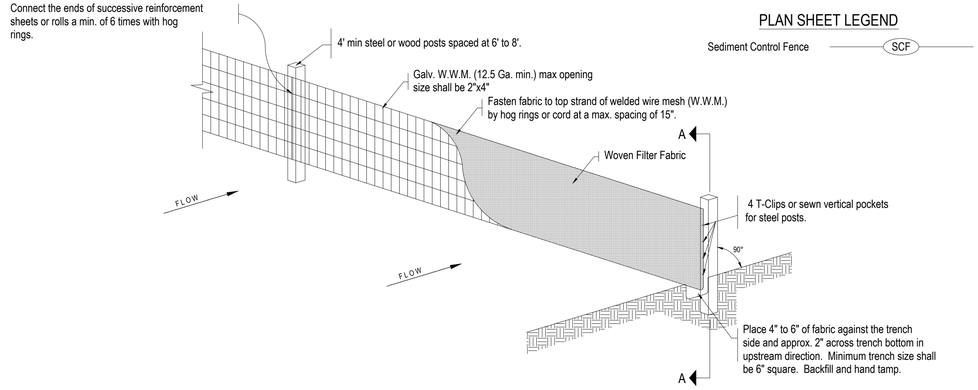
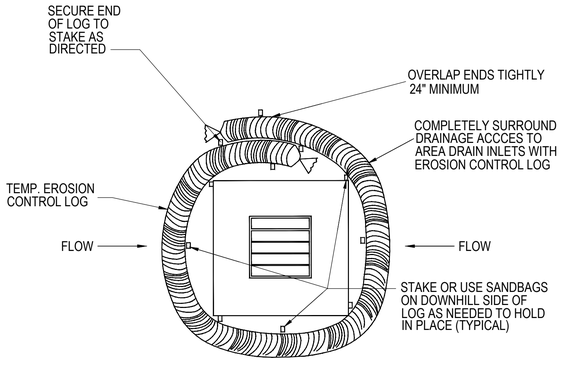
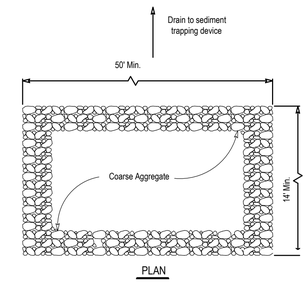


1. TEMPORARY SEDIMENT CONTROL FENCE



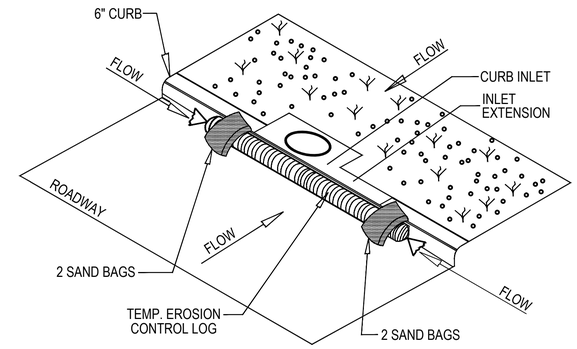
2. EROSION CONTROL LOG AT DROP INLET



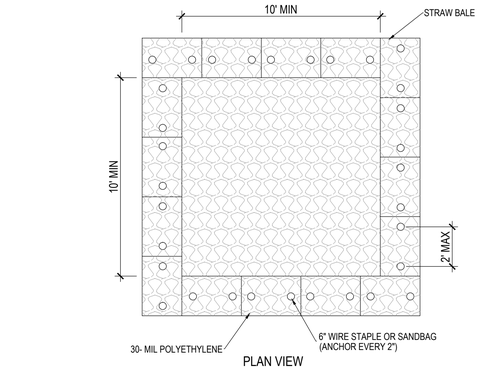
GENERAL NOTES

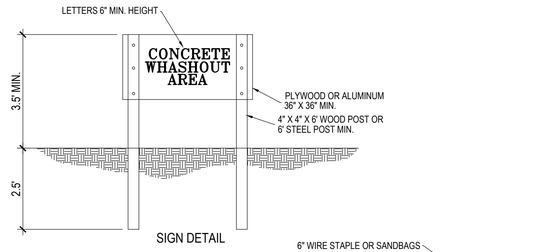
1. The length of the type 1 construction exit shall be as indicated on the plans, but not less than 50'.
2. The coarse aggregate should be open graded with a size of 4" to 8".
3. The approach transitions should be no steeper than 6:1 and constructed as directed by the Engineer.
4. The construction exit foundation course shall be flexible base, bituminous concrete, portland cement concrete or other material as approved by the Engineer.
5. The construction exit shall be graded to allow drainage to a sediment trapping device.
6. The guidelines shown hereon are suggestions only and may be modified by the Engineer.

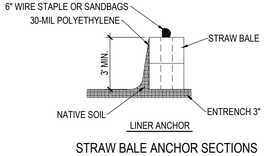
3. CONSTRUCTION EXIT (TYPE 1)



4. EROSION CONTROL LOG AT CURB INLET







STRAW BALE ANCHOR SECTIONS

5. TEMPORARY CONCRETE WHASHOUT FACILITY

GENERAL NOTES :

1. The guidelines shown hereon are suggestions only and may be modified by the engineer.

SEDIMENT CONTROL FENCE USAGE GUIDELINES

A sediment control fence may be constructed near the downstream perimeter of a disturbed area along a contour to intercept sediment from overland runoff. A 2-year storm frequency may be used to calculate the flow rate to be filtered.

Sediment control fence should be sized to filter a max. flow through rate of 100 GPM/FT . Sediment control fence is not recommended to control erosion from a drainage area larger than two acres.

GENERAL NOTES :

1. The guidelines shown hereon are suggestions only and may be modified by the engineer.
2. Hay bales shall be a minimum of 30" in length and weigh a minimum of 50 lbs.
3. Hay bales shall be bound by either wire or nylon or polypropylene string. The bales shall be composed enitrely of vegetable matter.
4. Hay bales shall be embedded in the soil a minimum of 4" and where possible 1/2 the height of the bale.
5. Hay bales shall be place in a row with ends tightly abutting the adjacent bales. The bales shall be placed with bindings parallel to the ground.
6. Hay bales shall be securely anchored in place with 3/8" dia. rebar or 2"x2" wood stakes driven through the bales. The first stake shall be angled towards the previously laid bale to force the bales together.

BALED HAY USAGE GUIDELINES

A Baled Hay Installation may be constructed near the downstream perimeter of a disturbed area along a contour to intercept sediment from overland runoff. A two year storm frequency may be used to calculate the flowrate to be filtered. The installation should be sized to filter a maximum flow thru rate of 5 GPM/FT of cross sectional area. Baled hay may be used at the following locations:

1. Where the runoff approaching the baled hay flows over disturbed soil less than 100'. If the slope of the disturbed soil exceeds 10%, the length of slope upstream the baled hay should be less than 50'.
2. Where the installation will be required for less than 3 months.
3. Where the contributing drainage area is less than 1/2 acre.

For Baled Hay Installations in small ditches, the additional following considerations apply:

1. The ditch sideslopes should be graded as flat as possible to maximize the drainage flowrate thru the hay.
2. The ditch should be graded large enough to contain the overtopping drainage when sediment has filled to the top of the baled hay.

Bales should be replace usually every two months or more often during wet weather when loss of structural integrity is accelerated.

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GENERAL NOTES

1. THIS CONTRACT STRUCTURAL DRAWINGS AND SPECIFICATIONS REPRESENT THE FINISHED STRUCTURE, UNLESS OTHERWISE INDICATED, THEY DO NOT INDICATE THE METHOD OF CONSTRUCTION. THE CONTRACTOR SHALL PROVIDE ALL MEASURES NECESSARY TO PROTECT THE STRUCTURE, WORKMEN, AND OTHER PERSONS DURING CONSTRUCTION. SUCH MEASURES SHALL NCLUDE, BUT NOT BE LIMITED TO, BRACING, SHORING FOR EARTH BANKS, FORMS, SCAFFOLDING, PLANKING SAFETY NETS, SUPPORT AND BRACING FOR CRANES, POLES, ETC. THE CONTRACTOR SHALL SUPERVISE AND DIRECT THE WORK AND HE SHALL BE SOLELY RESPONSIBLE FOR ALL CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES AND PROCEDURES. OBSERVATION VISITS TO THE SITE BY THE ARCHITECT OR THE ENGINEER DO NOT INCLUDE INSPECTION OF THE ABOVE AND BELOW ITEMS.
2. ALL CONSTRUCTION AND QUALITY OF MATERIALS SHALL COMPLY WITH THE GOVERNING BUILDING CODES AND REGULATIONS.
3. THE CONTRACTOR SHALL Verify ALL DIMENSIONS, ELEVATIONS, TOLERANCES AND CONDITIONS AT THE JOB SITE BEFORE COMMENCEMENT OF WORK AND SHALL IMMEDIATELY REPORT ANY DISCREPANCIES OR OMISSIONS TO THE ARCHITECT AND ENGINEER IN WRITING. ANY OMISSION OR CONFLICT BETWEEN THE VARIOUS ELEMENTS OF THE WORKING DRAWINGS AND/OR SPECIFICATIONS SHALL BE BROUGHT TO THE ATENTION OF THE ENGINEER BEFORE PROCEEDING WITH ANY WORK SO INVOLVED.
4. IN CASE OF CONFLICT, NOTES AND DETAILS ON THE BALANCE OF THE DRAWINGS TAKE PRECEDENCE OVER GENERAL NOTES AND TYPICAL DETAILS. DRAWINGS TAKE PRECEDENCE OVER SPECIFICATIONS.
5. WHERE CONSTRUCTION DETAILS ARE NOT SPECIFICALLY SHOWN OR NOTED FOR ANY PART OF THE WORK, SUCH DETAILS SHALL BE CONSTRUCTED IN ACCORDANCE WITH DETAILS SHOWN FOR SIMILAR CONDITIONS AND MATERIALS. WHERE SUFFICIENTLY SIMILAR WORK IS NOT SHOWN, THE ENGINEER SHALL BE CONSULTED FOR CLARIFICATION.
6. EACH SUBCONTRACTOR IS CONSIDERED AN EXPERT IN HIS RESPECTIVE FIELD AND SHALL PRIOR TO THE SUBMISSION OF A BID OR PERFORMANCE OF WORK, NOTIFY THE GENERAL CONTRACTOR, ARCHITECT, ENGINEER OR OWNER, IN WRITING OF ANY WORK CALLED OUT ON THE DRAWINGS IN HIS TRADE THAT CANNOT BE GUARANTEED OR PERFORMED AS INDICATED.
7. THE CONTRACTOR SHALL COORDINATE ALL MECHANICAL AND ELECTRICAL EQUIPMENT, AS TO WEIGHTS AND EXACT LOCATIONS, WITH STRUCTURAL SUPPORTS. IN THE EVENT THAT THE PURCHASED EQUIPMENT DEVIATES IN WEIGHT AND LOCATION FROM THOSE INDICATED ON THE PLANS, THE ARCHITECT AND ENGINEER MUST BE NOTIFIED AND APPROVAL OBTAINED PRIOR TO INSTALLATION.
8. THIS STRUCTURE IS DESIGNED AS A STABLE UNIT AFTER ALL COMPONENTS ARE IN PLACE. THE CONTRACTOR SHALL BE RESPONSIBLE TO PROVIDE TEMPORARY BRACING AS REQUIRED TO INSURE THE VERTICAL AND LATERAL STABILITY OF THE ENTIRE STRUCTURE, OR ANY PORTION THEREOF, DURING CONSTRUCTION.
9. NEITHER THE OWNER NOR THE ARCHITECT NOR THE ENGINEER WILL ENFORCE SAFETY MEASURES OR REGULATIONS. THE CONTRACTOR SHALL DESIGN, CONSTRUCT AND MAINTAIN ALL SAFETY DEVICES, INCLUDING SHORING AND BRACING, AND SHALL BE SOLELY RESPONSIBLE FOR CONFORMING TO ALL LOCAL, STATE AND FEDERAL SAFETY AND HEALTH STANDARDS, LAWS AND REGULATIONS.
10. TRADE NAMES AND MANUFACTURERS REFERRED TO ARE FOR QUALITY STANDARDS ONLY. SUBSTITUTIONS WILL BE PERMITTED AS APPROVED BY THE ENGINEER.
11. ANY OPTIONS OR APPROVED SUBSTITUTIONS ARE FOR CONTRACTORS CONVENIENCE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CHANGES, ADDITIONAL COSTS (INCLUDING REDESIGN BY THE ENGINEER), AND COORDINATION WITH ALL ITEMS THAT THE SUBSTITUTIONS MAY IMPACT.
12. THE ARCHITECT AND ENGINEER ARE TO BE NOTIFIED IN WRITING WHEN CONSTRUCTION AT THE SITE BEGINS.
13. ANY QUESTIONS RELATED TO INTERPRETATION OR INTENT OF THESE DRAWINGS SHALL BE REFERRED TO THE ENGINEER.
14. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO LOCATE AND PROJECT ANY EXISTING UNDERGROUND OR CONCEALED CONDUIT, PLUMBING, OR OTHER UTILITIES PRIOR TO BEGINNING ANY WORK.
15. PIPES, DUCTS, SLEEVES, CHASES, ETC. SHALL NOT BE PLACED IN BEAMS OR WALLS UNLESS SPECIFICALLY SHOWN OR NOTED ON THE STRUCTURAL MEMBER BE CUT FOR PIPES, DUCTS, ETC. UNLESS NOTED CONTRACTOR SHALL OBTAIN PRIOR APPROVAL FOR INSTALLATION OF ANY ADDITIONAL PIPES, DUCTS, ETC.

DESIGN CRITERIA

DESIGN LOADS, STRUCTURAL ANALYSIS AND PREPARATIONS OF STRUCTURAL MEMBERS ARE BASED UPON THE FOLLOWING CRITERIA:

1. CODE: IBC 2018
2. LATERAL LOADS
   - A. WIND SPEED (V^3 s): 144 MPH
   - B. EXPOSURE CATEGORY: C
   - C. IMPORTANCE FACTOR: 1.25
   - D. BUILDING CATEGORY III
3. VERTICAL LOADS
   - ROOF:
   - A. COLLATERAL LOAD: 15 PSF
   - B. DEAD LOAD: ACTUAL WEIGHT PSF
   - C. LIVE LOAD: (REDUCIBLE) 20 PSF
   - D. WIND UPLIFT LOAD (NET): SEE TABLE PSF
   - E. GROUND SNOW LOAD: 0 PSF
   - F. CRANE LOADS: NONE
   - G. MECHANICAL UNITS SEE PLANS
4. SUBSURFACE INFORMATION
   - A. PREPARED BY: Raba Kistner Consultants, Inc.
   - PROJECT NO.: AMA24-035-00
   - DATE: August 20, 2024
   - B. SHALLOW FOUNDATION
   - MINIMUM FOOTING DEPTH: 24 INCHES
   - MINIMUM FOOTING WIDTH: 12 INCHES
   - ALLOWABLE BEARING PRESSURE (CONTINUOUS FOOTINGS): 1900 PSF
   - ALLOWABLE BEARING PRESSURE (ISOLATED FOOTINGS): 2300 PSF
   - WIRE REINFORCEMENT INSTITUTE (WRI) CRITERIA
   - CLIMATIC RATING (Cw) 15
   - EFFECTIVE PLASTICITY INDEX (UNDISTURBED, NATIVE SOIL) 28
   - EFFECTIVE PLASTICITY INDEX (SITE IMPROVED SOIL) 28
   - PVR (UNDISTURBED SOIL) 1 1/2 INCH
   - PVR (WITH SITE IMPROVEMENT) 1.0 INCH

ALLOWANCE

1. IN ADDITION TO THE MATERIAL SHOWN, THE CONTRACTOR TO PROVIDE ADDITIONAL MATERIAL, FOR USE ON THE PROJECT AS DIRECTED BY THE STRUCTURAL ENGINEER FIELD REPRESENTATIVE. THE ALLOWANCE COST SHALL INCLUDE MATERIAL COST, LABOR COSTS AND PLACEMENT AT THE SITE.
2. REMAINING BALANCE AT THE END OF THE PROJECT SHALL BE RETURNED/CREDITED BACK TO THE OWNER.
3. THE ALLOWANCE SHALL APPEAR ON THE SCHEDULE OF VALUE AS A LINE ITEM.

MATERIAL	ALLOWANCE
CONCRETE	10 CU. YD.
REINFORCING STEEL	3000 LBS
STRUCTURAL STEEL	2000 LBS
CMU	0 SQ. FT.

SHOP DRAWINGS AND SUBMITTALS

1. SHOP DRAWINGS SHALL BE PREPARED AND SUBMITTED FOR REVIEW TO THE ENGINEER FOR EACH STRUCTURAL BUILDING MATERIAL AS INDICATED IN THE STRUCTURAL GENERAL NOTES AND THE CONTRACT SPECIFICATIONS. SEE THE CONTRACT SPECIFICATIONS FOR SUBMITTAL PROCEDURES AND ADDITIONAL INFORMATION
2. SHOP DRAWINGS SHALL USE DRAFTING LINE WORK AND LETTERING THAT IS CLEARLY LEGIBLE. SHOP DRAWINGS SHALL NOT CONTAIN NO REPRODUCTIONS OF THE CONTRACT DRAWING PLANS OR DETAILS.
3. SUBMIT STRUCTURAL SHOP DRAWINGS IN PDF FORMAT.
4. SHOP DRAWINGS SHALL NOT SHOW MATERIALS FOR MORE THAN ONE LEVEL OF THE SAME PLAN.
5. SHOP DRAWINGS SHALL SHOW CLEAR AND COMPLETE INFORMATION FOR THE FABRICATION (DETAIL SHEETS) AND/OR MATERIAL LISTING OF EACH INSTALLATION.
6. ALLOW A MINIMUM OF (2) WEEKS FOR REVIEW OF EACH SET OF SHOP DRAWINGS.
7. CONTRACTOR SHALL REVIEW THE SHOP DRAWINGS SUBMITTED BY THE SUB-CONTRACTOR AND COORDINATE SHOP DRAWINGS WITH ALL OTHER TRADING.
8. CONTRACTOR SHALL ANSWER ALL QUESTIONS AND CLARIFICATIONS BY THE SUB-CONTRACTOR BEFORE SUBMITTING TO ENGINEER FOR REVIEW. ANY QUESTIONS THAT THE CONTRACTOR CANNOT ANSWER WITH THE INFORMATION ON THE DRAWINGS SHALL CLEARLY BE MARKED FOR THE ENGINEER FOR REVIEW.
9. CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL DIMENSIONS, SEE NOTE NUMBER 3 UNDER GENERAL NOTES.
10. REVIEW OF SHOP DRAWINGS BY THE ENGINEER IS FOR GENERAL CONFORMANCE TO THE STRUCTURAL DRAWINGS. REVIEW OF THE SHOP DRAWINGS BY THE ENGINEER DOES NOT RELIEF THE CONTRACTOR FOR ANY ERRORS IN DIMENSIONS OR MATERIALS INDICATED ON THE SHOP DRAWINGS.
11. IF THERE IS ANY DISCREPANCY BETWEEN THE STRUCTURAL DRAWINGS AND SHOP DRAWINGS, THE INFORMATION SHOWN ON THE STRUCTURAL DRAWINGS GOVERN. INFORMATION THAT IS NOT INDICATED ON THE SHOP DRAWINGS SHALL BE OBTAINED FROM THE STRUCTURAL DRAWINGS.
12. PROVIDE SUBMITTALS FOR THE FOLLOWING ITEMS:

ITEM	REQUIRED
A. CONCRETE MIX DESIGN	X
B. CURING COMPOUND FOR CONCRETE.	X
C. REINFORCING STEEL	X
D. STRUCTURAL STEEL	X
E. STEEL JOIST	X
F. METAL DECKING (INDICATE LAYOUT AND TYPES OF DECK PANELS, ANCHORAGE DETAILS, REINFORCING CHANNELS, PANS, DECK OPENINGS, SPECIAL JOINTING, ACCESSORIES, AND ATTACHMENTS TO OTHER CONSTRUCTION.)	X
G. PRE-MANUFACTURED METAL BUILDING (INCLUDE CALC'S & REACTIONS)	X
H. PRE-MANUFACTURED WOOD TRUSSES	

REINFORCING STEEL

1. BAR REINFORCEMENT SHALL CONFORM TO THE FOLLOWING GRADES OF ASTM A615, INCLUDING SUPPLEMENT S1, GRADE 40 - #3 AND SMALLER GRADE 60 - #4 AND LARGER
2. DETAILS OF REINFORCEMENT SHALL BE IN ACCORDANCE WITH CHAPTER 7 OF THE AMERICAN CONCRETE INSTITUTE (ACI) 318, UNLESS OTHERWISE NOTED.
3. VERTICAL REINFORCEMENT SHALL BE TIED OR OTHERWISE FIXED IN POSITION AT THE TOP AND BOTTOM AND AT INTERMEDIATE LOCATIONS, SPACED NOT GREATER THAN 192 BAR DIAMETERS NOR FOUR (4) FEET ON CENTER.
4. WELDED STEEL WIRE FABRIC REINFORCEMENT SHALL CONFORM TO ASTM A185
5. LAPS OF WELDED STEEL WIRE FABRIC AT SPLICES SHALL BE NOT LESS THAN 12 INCHES.
6. WALLS, PILASTER, COLUMNS SHALL BE DOWELED TO THE SUPPORTING FOOTINGS WITH REINFORCING OF THE SAME SIZE, GRADE AND AT THE SAME SPACING AS THE VERTICAL REINFORCEMENT IN THE WALLS, PILASTER, OR COLUMNS.
7. BAR SUPPORTS SHALL BE PROVIDED IN ACCORDANCE WITH THE PROVISIONS OF "BAR SUPPORT SPECIFICATIONS" AS CONTAINED IN THE LATEST EDITION OF THE "MANUAL OF STANDARD PRACTICE" BY THE CONCRETE REINFORCING STEEL INSTITUTE (CRSI).
8. REINFORCING STEEL DETAILING, BENDING AND PLACING SHALL BE IN ACCORDANCE WITH THE CONCRETE REINFORCING STEEL INSTITUTE "MANUAL OF STANDARD PRACTICE", LATEST EDITION.
9. ALL REINFORCEMENT SHALL BE SECURELY TIED IN PLACE BEFORE PLACING CONCRETE OR GROUT. PROVIDE CONCRETE OR MASONRY CHAIRS AT 4'-0" O.C. MAX. (PLASTIC CHAIRS NOT ALLOWED.
10. PROVIDE CORNER BARS TOP AND BOTTOM AT ALL BEAM CORNERS AND DEAD END BEAM INTERSECTIONS. BARS TO EQUAL SIZE AND QUANTITY OF THE NOTED BEAM STEEL. BARS SHALL LAP BEAM REINFORCEMENT 40 BAR DIAMETERS.
11. BARS DETAILED AS CONTINUOUS SHALL BE LAPPED 40 BAR DIAMETERS AT SPLICES.
12. EXTEND SLAB REINFORCING STEEL PERPENDICULAR TO BEAM, TO THE TOP OUTSIDE REINFORCING BAR OF PERIMETER BEAMS. START THE SLAB REINFORCING STEEL, PARALLEL TO BEAM, NOT MORE THAN 6" FROM THE TOP INSIDE REINFORCING BAR OF PERIMETER BEAMS.
13. PROVIDE #4 "Z" BARS AT 12" ON CENTER WHERE THE SLAB STEPS DOWN MORE THAN 3". THE "Z" BARS SHALL LAP THE MAIN SLAB REINFORCING STEEL 40 BAR DIAMETERS.
14. ALL CONDUIT OR PLUMBING LINES IN SLAB SHALL BE PLACED BELOW SLAB REINFORCING. ALL CONDUIT TO BE NO GREATER THAN 1" DIAMETER AND TO BE PLACED IN CENTER OF SLAB. NO PLUMBING LINES GREATER THAN 1 INCH ALLOWED IN THE SLAB.
15. WELDING OF CROSSING BARS AND TACK WELDING OF REINFORCEMENT SHALL NOT BE PERMITTED.
16. WELDING OF REINFORCING STEEL, IF PERMITTED BY THE STRUCTURAL ENGINEER, SHALL BE PERFORMED IN ACCORDANCE WITH THE "STRUCTURAL WELDING CODE REINFORCING STEEL" ON THE AMERICAN WELDING SOCIETY, AWS D1.4-96 AS INCORPORATED IN CBC CHAPTER No. 19, AND BY CERTIFIED WELDERS QUALIFIED USING PROCEDURES CONTAINED THEREIN, E70XX ELECTRODES SHALL BE USED IN WELDING GRADE 60 REINFORCEMENT. REINFORCEMENT SHALL NOT BE WELDED UNTIL A CHEMICAL ANALYSIS SUFFICIENT TO DETERMINE THE CARBON EQUIVALENT (C.E.) IS PERFORMED. THE C.E. OF REINFORCING STEEL SHALL BE CALCULATED FORM THE CHEMICAL COMPOSITION AS SHOWN IN THE MILL TEST REPORT. IF MILL TEST REPORTS ARE NOT AVAILABLE, A CHEMICAL ANALYSIS SHALL BE MADE ON REINFORCEMENT REPRESENTATIVE OF THOSE TO BE WELDED. THE C.E. SHALL NOT EXCEED 0.55 AS CALCULATED PER CBC CHAPTER 19, A COPY OF THE MILL TEST OF REINFORCING STEEL IN CONCRETE MEMBERS. (SPECIAL INSPECTION IS REQUIRED FOR ALL FIELD WELDING).
17. CONTRACTOR SHALL SUBMIT REINFORCING STEEL SHOP DRAWINGS FOR REVIEW BEFORE FABRICATION AND INSTALLATION.
18. CONCRETE COVER FOR REINFORCING AS FOLLOWS:

EXPOSURE CONDITION	MINIMUM COVER	TOLERANCE
DRILLED PIERS, FOOTINGS AND OTHER PRINCIPAL STRUCTURAL MEMBERS IN WHICH CONCRETE IS DEPOSITED AGAINST GROUND:	3"	3/8"
WHERE CONCRETE SURFACES, AFTER REMOVAL OF FORMS, ARE EXPOSED TO WEATHER OR GROUND:		
FOR BARS 5/8" IN DIAMETER	2"	1/4"
FOR BARS 5/8" OR LESS IN DIAMETER	1 1/2"	1/4"
WHERE SURFACES ARE NOT DIRECTLY EXPOSED TO WEATHER OR GROUND:		
FOR SLAB ON GRADE (FROM TOP OF SLAB)	1 1/2"	1/4"
FOR BEAMS, COLUMNS	1 1/2"	1/4"
FOR JOISTS AND SLABS	1"	1/8"

20. LAPS AT BAR SPLICES, UNLESS NOTED OTHERWISE, SHALL BE AS FOLLOWS:

MASONRY - GRADE 60: LAP 50 DIA. (30" MIN.)
GRADE 40: LAP 48 DIA. (24" MIN.)

CONCRETE - LAP PER SCHEDULE BELOW

BAR SPLICE LAP LENGTH IN CONCRETE

BAR SIZE	f'c = 2000 PSI	f'c = 3000 PSI	f'c = 4000 PSI	f'c = 5000 PSI
#3	22	22	22	22
#4	29	29	29	29
#5	40	36	36	36
#6	57	46	43	43
#7	77	63	54	54
#8	100	82	71	71
#9	128	104	90	90
#10	162	132	115	115
#11	200	163	141	141

FOR WELDED WIRE FABRIC: SPACING OF WIRE PLUS 12".

SPECIAL NOTES TO OWNER

1. UNDER NORMAL CONDITIONS, AND FOR CONVENTIONAL BUILDINGS SUCH AS THE SUBJECT MATTER, REINFORCED CONCRETE AND MASONRY DEVELOP CRACKS. THE CRACKS ARE DUE TO INHERENT SHRINKAGE OF CONCRETE, CREEP AND RESTRAINING EFFECTS OF VERTICAL AND OTHER STRUCTURAL ELEMENTS TO WHICH THE BEAMS/SLABS ARE TIED.
2. THE CRACKS FORMED ARE NORMALLY COSMETIC. THE SLAB MAINTAINS ITS SERVICEABILITY AND STRENGTH REQUIREMENTS. IT IS EMPHASIZED THAT ALTHOUGH SPECIAL EFFORT IS MADE TO REDUCE THE POTENTIAL CAUSES AND NUMBER OF SUCH CRACKS, IT IS NOT PRACTICAL TO PROVIDE TOTAL ARTICULATION BETWEEN THE FLOOR SYSTEM AND ITS SUPPORTS AND THEREBY ACHIEVE COMPLETE INHIBITION OF ALL CRACKS.
3. MOST SUCH CRACKS DEVELOP OVER THE FIRST THREE YEARS OF THE LIFE OF THE FLOOR SYSTEM. CRACKS WHICH ARE WIDER THAN 0.01 INCH MAY NEED TO BE PRESSURE EPOXIED. REFER TO THE NOTES UNDER "ALLOWANCES".
4. THE OBJECT OF THE JOINTS PROVIDED IS TO ALLOW MOVEMENT. MOVEMENTS DUE TO CREEP AND SHRINKAGE MAY BE NOTICEABLE AT JOINTS UP TO TWO YEARS AFTER CONSTRUCTION, BEYOND WHICH MOVEMENTS DUE TO VARIATIONS IN TEMPERATURE WILL PERSIST.

STRUCTURAL STEEL

1. MATERIAL AND WORKMANSHIP SHALL CONFORM TO THE LATEST EDITION OF THE AISC SPECIFICATIONS FOR THE DESIGN, FABRICATION, AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS.
2. STRUCTURAL STEEL SHALL COMPLY WITH THE FOLLOWING ASTM DESIGNATIONS:

MATERIAL	DESIGNATION	STRENGTH
ANCHOR BOLTS	A36	Fy=36 ksi
PLATES	A36	Fy=36 ksi
ANGLES	A36	Fy=36 ksi
CHANNELS	A36	Fy=36 ksi
WIDE FLANGE SHAPES	A572	Fy=50 ksi
STEEL PIPE	A53 GRADE B	Fy=35 ksi
SQUARE & RECT. STEEL TUBES (HSS)	A500 GRADE B	Fy=46 ksi
ROUND TUBES (HSS)	500 GRADE B	Fy=42 ksi

3. ALL STRUCTURAL STEEL SHALL BE FABRICATED, ERECTED, AND PAINTED IN ACCORDANCE WITH THE SPECIFICATIONS FOR THE DESIGN, FABRICATION, AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS AS AMENDED TO DATE AND THE CODE OF STANDARD PRACTICE, LATEST EDITION AS ADOPTED BY THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION, AMENDED AS FOLLOWS:
   - SECTION 4.2.1, DELETE FIRST TWO SENTENCES.
   - SECTION 7., ALL REFERENCE TO OWNER SHALL BE CHANGED TO GENERAL CONTRACTOR.
   - SECTION 7.9.3, THE CONTRACTOR SHALL PROVIDE THE SEQUENCE AND SCHEDULE OF PLACEMENT OF NON-SELF SUPPORTING STEEL FRAMES.
   - SECTION 7.9.4, THE CONTRACTOR IS RESPONSIBLE FOR ANY AND ALL TEMPORARY BRACING.
4. WELDING SHALL BE DONE IN ACCORDANCE WITH THE STANDARD CODE FOR ARC AND GAS WELDING IN BUILDING CONSTRUCTION AS PUBLISHED BY THE AMERICAN WELDING SOCIETY, EXCEPT THAT ALL WELDING SHALL BE DONE BY THE ELECTRIC ARC PROCESS. ALL WELDING SHALL BE PERFORMED BY CERTIFIED WELDERS AND SHALL CONFORM TO ANSI/AWS D1.1-04
5. DETAILED AND OR SCHEDULED CONNECTIONS HAVE BEEN DESIGNED BY STRUCTURAL ENGINEER. ANY CONNECTION NOT DETAILED OR SCHEDULED OR ALTERED FOR FABRICATION PURPOSES SHALL BE SIZED AND DETAILED BY FABRICATOR AND SHALL BE MARKED FOR ENGINEER'S VERIFICATION. FABRICATOR SIZED AND DETAILED CONNECTIONS SHALL SUPPORT ONE HALF THE TOTAL UNIFORM LOAD CAPACITY SHOWN IN THE TABLES OF UNIFORM CONSTANTS, PART 2 OF THE AISC MANUAL OF STEEL CONSTRUCTION FOR THE GIVEN BEAM, SPAN AND GRADE OF STEEL SPECIFIED. THE EFFECT OF ANY CONCENTRATION LOADS MUST BE TAKEN INTO ACCOUNT.
6. SEE ARCHITECTURAL PLANS FOR MISCELLANEOUS STEEL ITEMS NOT INDICATED ON STRUCTURAL DRAWINGS. STEEL ITEMS SHOWN ON ARCHITECTURAL DRAWINGS AND NOT SPECIFIED ON THE STRUCTURAL DRAWINGS SHALL BE DESIGN BY THE STEEL FABRICATOR. SEE DESIGN CRITERIA FOR LOADING.
7. ALL WELDED CONNECTIONS SHALL BE MADE USING 1/4" FILLET WELD, U.N.O.
8. ALL BOLTED CONNECTIONS SHALL BE MADE USING 3/4" DIAMETER HIGH STRENGTH BOLTS, ASTM A325, BEARING TYPE CONNECTION w/ WASHERS AS REQUIRED FOR SIZE ON DESIGN DRAWINGS. SPECIAL INSPECTION REQUIRED FOR ALL HIGH STRENGTH BOLTING. ALL NUTS SHALL BE PER ASTM A563
9. ALL CONNECTION PLATES AND STIFFENERS SHALL BE MADE WITH 1/4" THICK PLATES, UNLESS OTHERWISE NOTED ON PLANS.
10. ALL STEEL (INCLUDING BOLTS) EXPOSED TO THE WEATHER SHALL BE HOT DIPPED GALVANIZED. (INCLUDES STEEL THAT IS ONLY COVERED WITH PLASTER OR STUCCO). SEE ARCHITECTURAL PLANS IF STRICTER REQUIREMENTS ARE REQUIRED.
11. ALL EXPOSED STEEL SHALL FOLLOW SECTION 10 OF THE CODE OF STANDARD PRACTICE OF AISC. SECTION 10 OF THE CODE ADDRESSES ARCHITECTURALLY EXPOSED STRUCTURAL STEEL (AESS)
12. CONNECTIONS SHALL BE PER HOLLOW STRUCTURAL SECTIONS, CONNECTION MANUAL BY AISC
13. WHERE STEEL MEMBER PASS THROUGH CMU WALLS, PROVIDE HALF INCH GAP BETWEEN THE CMU AND THE STEEL MEMBER. PROVIDE ELASTOMERIC MATERIAL BETWEEN THE THE STEEL MEMBER AND CMU WALL.
14. ALL BEAMS NOT SHOWN SHALL BE W14x26. ALL COLUMNS NOT SHOWN SHALL BE HSS4x4x1/4.
15. STEEL SHOP SHALL BE AISC CERTIFIED
16. HOLES FOR BOLTS IN STRUCTURAL STEEL SHALL BE DRILLED OR PUNCHED. BURNING OF HOLES SHALL NOT BE PERMITTED. UNLESS NOTED OTHERWISE, HOLES SHALL BE STANDARD SIZE 1/16 INCH LARGER THAN THE BOLT.
17. ALL STRUCTURAL STEEL SHAPES SHALL BE PRIMED WITH A RUST RESISTANT PRIMER BEFORE SHIPMENT TO THE PROJECT SITE. PRIMER SHALL NOT BE APPLIED TO THE IMMEDIATE AREA OF STEEL INTENDED TO RECEIVE SLIP CRITICAL BOLTED CONNECTIONS
18. HIGH STRENGTH BOLTS INSTALLATION SHALL BE CONTINUOUSLY INSPECTED BY A SPECIAL INSPECTOR. FOLLOWING ARE REQUIREMENTS OF THE SPECIAL INSPECTOR:
   - A. HE SHALL VERIFY THE MILL CERTIFICATES FOR MATERIAL.
   - B. HE SHALL VERIFY THAT THE MATERIAL USED ARE PROPERLY STORED AND PREPARED FOR USE.
   - C. HE SHALL VERIFY THAT CONSTRUCTION DETAILS, PROCEDURES, TOOL CALIBRATIONS WORKMANSHIP ARE IN ACCORDANCE WITH THE CONSTRUCTION DOCUMENTS AND AND BUILDING CODE.
   - D. FOR SNUG-TIGHT CONNECTIONS, HE SHALL VERIFY THAT THE PLIES OF THE CONNECTED ELEMENTS HAVE BEEN BROUGHT INTO SNUG CONTACT WITH EACH OTHER.
   - E. FOR SLIP-TIGHT CONNECTIONS, HE SHALL VERIFY THE PRETENSION METHOD SELECTED BY THE CONTRACTOR HAS INDUCED THE REQUIRED MINIMUM TENSION IN THE BOLT.
   - F. A CERTIFICATE OF INSPECTION SHALL BE FURNISHED BY THE SPECIAL INSPECTOR TO THE BUILDING OFFICIAL PRIOR TO HIS INSPECTION AND TO THE ARCHITECT AND ENGINEER.
19. WELDING IN THE FIELD SHALL BE CONTINUOUSLY INSPECTED, BY A SPECIAL INSPECTOR FOLLOWING ARE REQUIREMENTS OF THE SPECIAL INSPECTOR:
   - A. HE SHALL VERIFY THAT THE MATERIAL USED ARE PROPERLY STORED AND PREPARED FOR USE.
   - B. HE SHALL VERIFY THE WELDER'S QUALIFICATIONS.
   - C. HE SHALL VERIFY THAT CONSTRUCTION DETAILS, PROCEDURES AND WORKMANSHIP ARE IN ACCORDANCE WITH THE CONSTRUCTION DOCUMENTS AND BUILDING CODE.
   - D. A CERTIFICATE OF INSPECTION SHALL BE FURNISHED BY THE SPECIAL INSPECTOR TO THE BUILDING OFFICIAL PRIOR TO HIS INSPECTION AND TO THE ARCHITECT AND ENGINEER.
20. ALL NON SHRINK GROUT FOR LEVELING OF BASE PLATES SHALL HAVE A MINIMUM 5000 PSI COMPRESSIVE STRENGTH AT 28 DAYS. GROUT SHALL COMPLY WITH CORPS OF ENGINEERS SPECIFICATION CRD-C 621.

Drawing List	
Sheet Number	Sheet Name
S101	General Notes
S102	General Notes
S201	Foundation Plan
S401	Typical Concrete Details
S402	Foundation Details
S404	Typical CMU Details

CAST-IN-PLACE CONCRETE

1. VERIFY ALL DIMENSIONS. COORDINATE WITH ARCHITECTURAL PLANS PRIOR TO CONSTRUCTION AND NOTIFY ARCHITECT AND/OR ENGINEER OF ANY DISCREPANCIES.
2. ALL CONCRETE WORK SHALL BE IN ACCORDANCE WITH THE AMERICAN CONCRETE INSTITUTE SPECIFICATIONS, ACI #301 LATEST EDITION. DRILLED PIERS SHALL COMPLY WITH ACI 336.1 AND ACI 336.3R, LATEST EDITIONS
3. ALL DETAILING, FABRICATION AND ERECTION OF REINFORCING BARS, ACCESSORIES UNLESS OTHERWISE NOTED, SHALL BE IN ACCORDANCE WITH THE ACI "MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE", ACI #315 LATEST EDITION
4. THE MINIMUM 28 DAYS CYLINDER STRENGTH SHALL BE AS FOLLOWS:

LOCATION	STRENGTH AT 28 DAYS	MAXIMUM SLUMP	SIZE OF LARGE AGGREGATE	WATER/CEMENT RATIO
FOUNDATIONS	3000 PSI	5"	1 1/2"	0.53
SLAB ON GRADE	3000 PSI	5"	1 1/2"	0.53
GRADE BEAMS	3000 PSI	5"	1 1/2"	0.53
WALL	3000 PSI	6"	3/4"	0.53

5. NO HORIZONTAL CONSTRUCTION JOINTS WILL BE PERMITTED IN SLABS OR BEAMS.
6. VERTICAL CONSTRUCTION JOINTS IN SLABS ARE TO BE AS SHOWN ON PLANS OR AS APPROVED BY ENGINEER.
7. ALL OPENINGS IN SLAB (FOR PIPING, DRAINS, ETC.) SHALL BE SEALED WITH 1/2 SEALANT '2A' (SELF-LEVELING 2-PART POLYURETHANE).
8. UTILITIES THAT PROJECT THROUGH SLAB FLOORS SHOULD BE DESIGNED WITH EITHER SOME DEGREE OF FLEXIBILITY OR WITH SLEEVES IN ORDER TO PREVENT DAMAGE TO THESE LINE SHOULD VERTICAL MOVEMENT OCCUR.
9. BACKFILL AROUND PERIMETER TO PROVIDE POSITIVE DRAINAGE AWAY FROM SLAB.
10. FLOOR TOLERANCES
    F-NUMBER SYSTEM

	COMPOSITE	MINIMUM LOCAL VALUE
FLATNESS (F) :	30	23
LEVELNESS (F) :	25	19

11. ANCHOR BOLTS, DOWELS, INSERTS, ETC. SHALL BE SECURELY TIED IN PLACE PRIOR TO PLACING CONCRETE.
12. REFER TO ARCHITECTURAL, MECHANICAL, PLUMBING, AND ELECTRICAL DRAWINGS FOR ALL MOLDS. GROOVES, REGLETS, ORNAMENTAL CLIPS, PIPES, CONDUITS, INSERTS, ETC. TO BE CAST IN CONCRETE. PROVIDE OVERSIZED SLEEVES FOR PLUMBING AND ELECTRICAL CONDUITS AND PIPES. NO PIPES OR DUCTS SHALL BE PLACED IN CONCRETE FOOTINGS, OR SLAB UNLESS SPECIFICALLY DETAILED IN THESE PLANS, OR AS DIRECTED BY THE ENGINEER.
    MECHANICALLY VIBRATE ALL CONCRETE WHEN PLACED.
13. CONCRETE TESTING SHALL BE ONE SET OF CYLINDERS FOR EVERY 50 CUBIC YARDS
14. OR PORTION THEREOF FOR EACH TYPE OF CONCRETE POURED ON ANY GIVEN DAY. ONE SET CONSISTS OF 2 CYLINDERS TESTED FOR COMPRESSION AT 7 DAYS AND 2 CYLINDERS AT 28 DAYS.
15. VAPOR RETARDANT
    - A. VAPOR RETARDANT (UNDER SLAB): SHALL CONFORM TO ASTM E1745, CLASS C OR BETTER AND SHALL HAVE A MINIMUM WATER VAPOR PERMEANCE OF 0.044 PERMS WHEN TESTED IN ACCORDANCE WITH ASTM E96. VAPOR RETARDANT SHALL BE NO LESS THAN 15 MILS THICK.
    - APPROVED PRODUCTS
    - A. STEGO WRAP (15 MIL), BY STEGO INDUSTIES LLC. (887) 464-7834.
    - B. HUSKY YELLOW GUARD (15 MIL)
    - C. OR APPROVED EQUAL BEFORE BIDDING PER SECTION 01600
    - INSTALLATION
    - A. LAY SHEETS SMOOTHLY, STRETCH AND WEIGHT EDGES, LAP JOINTS TWELVE (12) INCHES AND SEAL WITH TAPE AS SPECIFIED BY VAPOR RETARDANT MANUFACTURER. TURN BARRIER UP SIX INCHES AT WALLS AND AT ALL PIPES, ABUTMENTS, ETC. TAPE AND SEAL AT PENETRATIONS AND AT EDGES.
    - B. AT GRADE BEAMS, EXTEND VAPOR RETARDANT DOWN SIDES OF BEAM TRENCHES AND ALONG BOTTOM OF FOOTING EXCAVATIONS, SECURE TO SIDES OF TRENCH.
    - PATCHING:
    - A. PATCH ALL PUNCTURES WITH A MINIMUM OVERLAP OF 6" IN ALL DIRECTIONS AND TAPE AROUND ENTIRE PERIMETER OF REPAIR.

A. PREINSTALLATION CONFERENCE.
1. AT LEAST 30 DAYS PRIOR TO THE START OF THE CONCRETE SLAB CONSTRUCTION SCHEDULE, THE CONTRACTOR SHALL CONDUCT A MEETING TO REVIEW THE PROPOSED MIX DESIGNS AND

SPECIAL INSPECTION, MATERIALS TESTING.

1. RESPONSIBILITIES OF THE OWNER
   A. EMPLOY AND PAY THE SPECIAL INSPECTION AGENCY TO PERFORM INSPECTIONS SPECIFIED IN THIS SECTION AND THOSE REQUIRED BY AUTHORITIES HAVING JURISDICTION.
   B. EMPLOY AND PAY THE MATERIALS TESTING LABORATORY TO PERFORM TESTS SPECIFIED IN THIS SECTION AND THOSE REQUIRED BY AUTHORITIES HAVING JURISDICTION.
      1) RETESTING - THE CONTRACTOR SHALL REIMBURSE THE OWNER FOR RE-TESTING WHERE RESULTS OF INSPECTIONS AND TESTS PROVE UNSATISFACTORY AND INDICATE NONCOMPLIANCE WITH REQUIREMENTS.
   C. EMPLOY THE DESIGN PROFESSIONAL RESPONSIBLE FOR THE STRUCTURAL DESIGN OR ANOTHER ENGINEER OR ARCHITECT DESIGNATED BY THE (DPR) TO PERFORM STRUCTURAL OBSERVATION. (REF 1702)
2. DEFINITIONS
   A. APPROVED FABRICATOR: A FABRICATOR REGISTERED AND APPROVED BY THE BUILDING OFFICIAL AND ENGINEER OF RECORD, TO PERFORM WORK, OFF SITE, REQUIRING SPECIAL INSPECTION WITHOUT SPECIAL INSPECTION. THE DESCRIPTION IN SECTION 1701.1 OF THE 1998 CALIFORNIA BUILDING CODE IS APPLICABLE.
   B. SPECIAL INSPECTION AGENCY: THE ACCREDITED INSPECTION BODIES DESIGNATED HEREIN AND APPROVED BY THE ENGINEER OF RECORD TO PERFORM SPECIAL INSPECTION AS REQUIRED BY THE BUILDING CODE AND THE PROJECT SPECIFICATIONS AND AS DESCRIBED IN SECTION 1701 1998 CALIFORNIA BUILDING CODE.
   C. SPECIAL INSPECTOR: A QUALIFIED PERSON, EMPLOYED BY THE SPECIFIED SPECIAL INSPECTION AGENCY, WHO HAS DEMONSTRATED COMPETENCE TO THE SATISFACTION OF THE BUILDING OFFICIAL FOR INSPECTION OF THE PARTICULAR TYPE OF CONSTRUCTION OR OPERATION REQUIRING SPECIAL INSPECTION. DUTIES INCLUDE VISUAL OBSERVATIONS AND FIELD MEASUREMENTS OF MATERIALS, OBTAINING SPECIMENS FOR TESTS AND RELATED ACTIONS INCLUDING PREPARATION OF REPORTS.
   D. TESTING LABORATORY: AN ACCREDITED MATERIALS TESTING LABORATORY, APPROVED BY THE ENGINEER OF RECORD, TO MEASURE, EXAMINE, TEST, CALIBRATE OR OTHERWISE DETERMINE THE CHARACTERISTICS OR PERFORMANCE OF CONSTRUCTION MATERIALS.
   E. CONTINUOUS INSPECTION: ON SITE INSPECTION BY THE SPECIAL INSPECTOR ON A CONTINUOUS BASIS OBSERVING ALL WORK REQUIRING SPECIAL INSPECTION
   F. PERIODIC INSPECTION: INTERMITTENT INSPECTION AS PERMITTED BY THE PLAN SPECIFICATIONS AT PREDETERMINED INTERVALS OR MORE FREQUENTLY AS WORK PROGRESSES. NO SIGNIFICANT ELEMENTS OR AREAS SHALL BE COVERED BY ADDITIONAL WORK UNTIL APPROVED BY THE MUNICIPAL BUILDING INSPECTOR AND/OR THE SPECIAL INSPECTOR.
   G. STRUCTURAL OBSERVATION: THE VISUAL OBSERVATION, BY THE ENGINEER OF RECORD OR HIS DESIGNEE, INCLUDING BUT NOT LIMITED TO THE ELEMENTS AND CONNECTIONS, OF THE STRUCTURAL SYSTEM, FOR GENERAL CONFORMANCE TO THE APPROVED PLANS AND SPECIFICATION, AT SIGNIFICANT CONSTRUCTION STAGES AND AT COMPLETION OF THE STRUCTURAL SYSTEM. STRUCTURAL OBSERVATION DOES NOT INCLUDE OR WAIVE THE RESPONSIBILITY FOR THE SPECIAL AND MUNICIPAL INSPECTIONS REQUIRED BY CODES AND SPECIFICATIONS.
   H. EOR: ENGINEER OF RECORD
   I. DPR: ENGINEER OF RECORD/DESIGN PROFESSIONAL OF RECORD
   J. SPECIAL INSPECTION AND MATERIALS TESTING
      THIS SECTION APPLIES TO THE STRUCTURAL PORTIONS OF THE PROJECT REQUIRING SPECIAL INSPECTION. THE SPECIAL INSPECTORS DUTIES ARE DESCRIBED IN CBC 1701.3 AND CBC 1701.5
      DOCUMENTED METHODS AND PROCEDURES SHALL BE USED FOR INSPECTION AND TESTING REQUIRED OF CONTRACTUAL DOCUMENTS, AND FOR ESTABLISHING ACCEPTANCE CRITERIA. ALL INSTRUCTIONS, STANDARDS, PROCEDURES, CHECKLISTS RELEVANT TO THE WORK WILL BE KEPT UP TO DATE AND READILY AVAILABLE FOR USE. NO INSPECTION OR TEST WILL BE PERFORMED IF THE SAFETY OF THE TESTING PERSONNEL IS IN QUESTION DUE TO JOB SITE CONDITIONS. PRIOR TO PROJECT COMMENCEMENT, THE TESTING AGENCY WILL CONFER WITH AND OBTAIN THE APPROVAL FROM THE APPROPRIATE DESIGN PROFESSIONAL OF RECORD REGARDING THE INSPECTION AND TESTING PROCEDURES OR SPECIFICATIONS INCLUDING ANY APPROPRIATE ASTM METHODS, CODE REQUIREMENTS OR PERFORMANCE REQUIREMENTS. AT THE START OF AND DURING EACH INSPECTION OF THE PROJECT TO ASCERTAIN PROPOSED CONFORMITY OF MATERIALS, PERSONNEL QUALIFICATIONS, AS REQUIRED, AND PROCEDURS WITH APPLICABLE CODES, PLANS, AND SPECIFICATIONS.
      1. ALL INSPECTIONS SHALL BE PERFORMED BY AN ACCREDITED, APPROVED SPECIAL INSPECTION AGENCY EMPLOYED BY THE OWNER OR OWNER'S AGENT, NOT THE CONTRACTOR OR SUBCONTRACTOR,
         ACCREDITATION TO ASTM E-329-95C, STANDARD
         SPECIFICATIONS FOR AGENCIES ENGAGED IN THE TESTING AND/OR INSPECTION OF MATERIALS USED IN CONSTRUCTION, IS PREFERRED.
         COPIES OF THE TEST RESULTS AND FINAL REPORTS SHALL BE FURNISHED TO THE ENGINEER OF RECORD (EOR) IN ADDITION TO OTHER NORMAL DISTRIBUTIONS, WITHIN TWO DAYS OF THE TEST. IN THE CASE OF DISCREPANCIES OR DEFICIENCIES, THE SPECIAL INSPECTION AGENCY SHALL IMMEDIATELY NOTIFY THE EOR. TESTING FREQUENCY SHALL BE PER APPLICABLE STRUCTURAL MASONRY, REINFORCED CONCRETE, AND STRUCTURAL STEEL WELDING CODES AND STANDARDS AND ARE PART OF THIS SPECIFICATION.
         A. CERTIFICATE OF SATISFACTORY COMPLETION OF WORK REQUIRING SPECIAL INSPECTION MUST BE COMPLETED AND SUBMITED TO THE INSPECTION SERVICES DIVISION BY THE CONTRACTOR.
      3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING THE TEST AND/OR INSPECTION FIRM WITH A CONSTRUCTION SCHEDULE TO FACILITATE THE PROPER COORDINATION.
      4. THE SPECIAL INSPECTOR SHALL FURNISH DAILY INSPECTION REPORTS TO THE BUILDING OFFICIAL, THE ARCHITECT, AND THE ENGINEER AT A MINIMUM PER WEEK FREQUENCY. THE SPECIAL INSPECTOR SHALL SUBMIT A FINAL REPORT, SIGNED BY BOTH HE AND HIS SUPERVISOR, STATING WHETHER THE WORK REQUIRING SPECIAL INSPECTION WAS IN CONFORMANCE WITH THE APPROVED PLANS AND SPECIFICATIONS AND THE WORKMANSHIP PROVISIONS OF THE CBC.
      5. ALL DISCREPANCIES SHALL BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE CONTRACTOR FOR CORRECTION; THEN IF UNCORRECTED, TO THE PROPER DESIGN AUTHORITY AND THE BUILDING OFFICIAL.
      6. SPECIAL INSPECTION REPORTS
      THESE REPORTS SHALL INCLUDE, AS A MINIMUM, THE FOLLOWING INFORMATION:
      A. PERMIT NUMBER
      B. NAME OF THE MUNICIPAL INSPECTOR, IF AVAILABLE, AND OF THE GOVERNING MUNICIPALITY
      C. SPECIAL INSPECTION AGENCY NAME, ADDRESS, AND PHONE NUMBER
      D. UNIQUE IDENTIFICATION OF THE REPORT AND OF EACH PAGE.
      E. CLIENT NAME AND ADDRESS
      F. NAME AND ADDRESS OF THE DESIGN PROFESSIONAL OF RECORD, AND OTHER DESIGNERS OR ENGINEERS APPLICABLE TO THE PROJECT
      G. DESCRIPTION OF THE TYPE OF INSPECTION PERFORMED
      H. ANY UNRESOLVED DEVIATIONS, EXCLUSIONS, AND ADDITIONS TO OR FROM THE APPROVED DRAWINGS AND SPECIFICATIONS RELEVANT TO THE SPECIFIC INSPECTION OR TEST.
      I. COMPLIANCE FINDINGS AND REFERENCE
      J. DESCRIPTION OF LOCATION WHERE THE INSPECTION WAS PERFORMED WITHIN THE PROJECT
      K. TIME AND DATE OF THE INSPECTION
      L. MEASUREMENTS, EXAMINATIONS, AND DERIVED RESULTS SUPPORTED BY TABLES, GRAPHS, SKETCHES, OR PHOTOGRAPHS AS APPROPRIATE
      M. THE NAME, SIGNATURE, TITLE, AND IDENTIFICATION NUMBER, AS APPROPRIATE, OF THE FIELD INSPECTOR PERFORMING THE INSPECTION
      N. IDENTIFICATION OF SUBCONTRACTORS EMPLOYED TO CARRY OUT TESTS OR PARTS OF TESTS
      7. TESTS REPORTS
      LABORATORY TESTS AND MILL CERTIFICATIONS ARE REQUIRED TO BE SUBMITTED TO THE ENGINEER OF RECORD. THESE REPORTS SHALL INCLUDE, BUT NOT BE LIMITED TO THE FOLLOWING:
      1. CONCRETE CYLINDERS
      2. REINFORCING STEEL
      3. STRUCTURAL STEEL
      4. CONCRETE MIXES
      5. CONCRETE ANCHORS
      8. SPECIAL INSPECTION BY A SPECIAL OR DEPUTY INSPECTOR FROM AN ACCREDITED, EOR APPROVED INSPECTION AGENCY AND WITH THE APPROPRIATE CURRENT MUNICIPAL LICENSES AND CERTIFICATIONS SHALL BE REQUIRED FOR THE TYPE OF WORK LISTED BELOW.

8A. CONTINUOUS INSPECTION REQUIRED FOR THE FOLLOWING:
   A. REINFORCED CONCRETE:
      1. DURING PLACEMENT OF REINFORCED CONCRETE WHERE THE STRUCTURAL DESIGN IS BASED ON F'C GREATER THAT 3,000 PSI AND THE TAKING TEST SPECIMENS. THE NUMBER OF AND FREQUENCY OF TAKING OF TEST SPECIMENS SHALL BE THE MINIMUM REQUIRED BY THE GOVERNING MUNICIPAL BUILDING CODE OR AS SPECIFIED BY THE APPROVED STRUCTURAL PLANS, WHICHEVER IS THE GREATER NUMBER.
      2. DURING THE PLACEMENT OF REINFORCING STEEL AND PRE STRESS TENDONS UNLESS THE SPECIAL INSPECTOR HAS INSPECTED FOR CONFORMANCE WITH THE APPROVED PLANS PRIOR TO THE CLOSING OF FORMS OR THE DELIVERY OF CONCRETE TO THE JOBSITE.
      3. DURING THE PLACEMENT OF REINFORCING STEEL AND CONCRETE FOR CAST-IN-PLACE DRILLED PILES OR CAISSONS.
      4. INSPECTION IS REQUIRED ON CAST-IN-PLACE PILES OR CAISSONS, EVEN IF F'C IS LESS THAN 2,500 PSI.
      5. PRIOR TO AND DURING THE PLACEMENT OF CONCRETE AROUND BOLTS WHEN STRESS INCREASES PERMITTED BY FOOTNOTE 5 OF TABLE 19E, SECTION 1925 OF THE UNIFORM BUILDING CODE FOR THE USE OF FULL VALUES FOR EMBEDDED BOLTS.
      6. PRIOR TO AND DURING THE INSTALLATION OF ANCHORS REQUIRING TO BE DRILLED INTO CONCRETE.
      7. DURING THE STRESSING AND GROUTING OF TENDONS IN PRE STRESSED
      8. CONTINUOUS INSPECTION FOR THE PLACEMENT OF THE REINFORCEMENT AND CONCRETE AT CONCRETE MOMENT FRAMES WITHIN SEISMIC ZONES 3 & 4
      9. SHOT CRETE PLACEMENT AND DURING THE TAKING OF TEST SPECIMENS. PERIODIC INSPECTION FOR REINFORCED CONCRETE SHALL BE PERFORMED WHEN SPECIFIED, AS MINIMUMS:
         1. AT THE START OF AND DURING EACH INSPECTION OF THE PROJECT TO ASCERTAIN PROPOSED CONFORMITY OF MATERIALS, PERSONNEL QUALIFICATIONS AS REQUIRED, AND PROCEDURES WITH THE APPLICABLE CODES, PLANS AND SPECIFICATIONS.
         2. REINFORCEMENT VERIFICATION PRIOR TO THE PLACEMENT OF CONCRETE
         3. DURING THE PLACEMENT OF CONCRETE
         4. DURING THE MOLDING, CONSTRUCTION OF TAKING OF COMPRESSION SAMPLES, BEAMS, CORES OR PANELS.
         5. AT SUCH FREQUENCY AS NECESSARY TO CLEARLY CONFIRM THE PLACEMENT OF TIES, HOOPS, STIRRUPS, CONNECTIONS, AND ANY ADDITIONAL SPECIFIED REINFORCEMENT (IE @ OPENINGS, BEAMS, CORNERS, COLUMNS, PIERS, AND CAISSONS) BEFORE THEY ARE COVERED.
         6. DURING SAMPLING OF CONCRETE AT DISCHARGE FROM MIXER.
         7. BEFORE ANY CONCRETE IS PLACED FOR VERIFICATION OF MIX DESIGN
         8. ALL FUNCTIONS AT THE BATCHING PLANT FOR READY MIX. THIS COULD INCLUDE CEMENT SAMPLING OR TEST RESULTS, GRAVEL GRADATION, CHECKING CALIBRATION OF EQUIPMENT AND ADMIXTURE APPROVALS.
   B. STRUCTURAL WELDING - GENERAL - INSPECTOR'S DUTIES
      1. ALL FIELD WELDING NOT DONE IN AN APPROVED FABRICATORS SHOP EXCEPT THAT PERIODIC INSPECTION THE FREQUENCY OF WHICH IS DETERMINED PRIOR TO THE START OF THE PROJECT SHALL BE ALLOWED PER SECTION 1701.5, #5 EXCEPTIONS.
      2. DURING ALL FIELD WELDING OF SPECIAL MOMENT-RESISTING FRAMES; IN ADDITION, NONDESTRUCTIVE TESTING AS REQUIRED BY SECTION 1703.
      3. THE SPECIAL INSPECTOR SHALL REVIEW EOR APPROVED WELDING PROCEDURES SPECIFICATIONS (WPS) WHEN OTHER THAN STANDARD AWS PRE QUALIFIED JOINTS AND PROCEDURES ARE INVOLVED.
      4. THE SPECIAL INSPECTOR SHALL REVIEW APPLICABLE SECTION OF REFERENCED CODES, PARTICULARLY THE AMERICAN WELDING SOCIETY STRUCTURAL WELDING CODE (AWS D1.1) AND THE MANUAL, AND SPECIFICATIONS OF THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC).
      5. THE SPECIAL INSPECTOR SHALL REVIEW MILL TEST REPORTS AND CHECK HEAT NUMBERS WITH MATERIAL AS RECEIVED. VERIFY THAT PROPER IDENTIFICATION OF STEEL IS MAINTAINED DURING FABRICATION.
      6. THE SPECIAL INSPECTOR SHALL, WHEN REQUIRED BY PROJECT SPECIFICATIONS, MARK SAMPLE LOCATION WITH STEEL STAMP ON EACH PIECE TESTED.
      7. THE SPECIAL INSPECTOR SHALL RECORD SAMPLE NUMBER AND LOCATION AND CHECK THAT SAMPLE IDENTIFICATION IS MAINTAINED AS SAMPLES ARE DELIVERED TO LABORATORY AND TESTED.
      8. THE SPECIAL INSPECTOR SHALL WHEN STEEL MEMBERS ARE DELIVERED TO FINISH AND NO "CROP ENDS" ARE AVAILABLE FOR SAMPLE CUTTING, COORDINATE CUTTING AND PATCHING REQUIREMENTS WITH THE ARCHITECT/ENGINEER
   9A. WELDING OBSERVATION - (APPLICABLE TO SHOP AND FIELD)
      1. THE SPECIAL INSPECTOR SHALL CHECK EACH WELDER'S CERTIFICATION AND VERIFY THAT THE WELDER DOES WORK ONLY AS QUALIFIED BY HIS CERTIFICATION
      2. THE SPECIAL INSPECTOR SHALL KEEP A WRITTEN RECORD OF EACH WELDER BY NAME, IDENTIFICATION NUMBER AND HIS IDENTIFYING STEEL MARK, IF APPLICABLE, AND THE PERCENTAGE OF REJECTABLE WELDS.
      3. THE SPECIAL INSPECTOR SHALL UPON DETECTION OF REJECTABLE WELD (EITHER VISUALLY OR BY NONDESTRUCTIVE TEST), THE INSPECTOR OF RECORD WILL NOTIFY THE WELDER AND HIS FOREMAN FOR VERIFICATION OF DEFECT. THE INSPECTOR OF RECORD WILL OBSERVE REMOVAL, REWORK, OR REPAIRS.
      4. THE SPECIAL INSPECTOR SHALL CHECK STRUCTURAL MEMBERS FOR THICKNESS ADJACENT TO WELDS, OPENING, ETC. REWORK, OR REPAIRS.
      5. THE SPECIAL INSPECTOR SHALL INSPECT JOINTS FOR PROPER PREPARATION, INCLUDING BEVEL, ROOT FACES, ROOT OPENING, ETC. REWORK, OR REPAIRS.
      6. THE SPECIAL INSPECTOR SHALL CHECK THE TYPE AND SIZE OF ELECTRODES TO BE USED FOR THE VARIOUS JOINTS, AND POSITIONS. CHECK THE STROGAGE FACILITIES TO SEE IF THEY ARE ADEQUATE TO KEEP THE ELECTRODES DRY.
      7. THE SPECIAL INSPECTOR SHALL OBSERVE THE TECHNIQUE OF EACH THE SPECIAL INSPECTOR SHALL WELDER WITH USE OF A WELDING INSPECTION SHIELD.
      8. THE SPECIAL INSPECTOR SHALL VERIFY THE USE OF PROPER PREHEAT AND INTER PASS TEMPERATURES. INSPECTOR SHALL WELDER WITH USE OF A WELDING INSPECTION SHIELD.
      9. THE SPECIAL INSPECTOR SHALL CONTINUOUSLY OBSERVE MULTI-PASS WELDS. CONTINUOUS INSPECTION IS DEFINED AS FOLLOWS: THE INSPECTOR IS PRESENT IN THE WELDING AREA AT ALL TIMES AND IS FULLY AWARE OF THE PROGRESS OF THE WELDING AT ANY GIVEN TIME. THE INSPECTOR MAY WATCH MULTIPLE WELDERS PROVIDED THEY ALL BE IN THE AREA, CLOSE ENOUGH FOR EFFECTIVE VISUAL INSPECTION OF THE WORK PERFORMED.
      10. THE SPECIAL INSPECTOR SHALL DETERMINE THAT THE OPERATOR IS CAPABLE OF PRODUCING THE REQUIRED WELDS.
      11. THE SPECIAL INSPECTOR SHALL OBSERVE SINGLE PASS FILLET WELDS PERIODICALLY, OR MORE OFTEN IF CODES AND SPECIFICATIONS REQUIRE.
      12. THE SPECIAL INSPECTOR SHALL, IF STRAIGHTENING OR RESTRAINING OF WELDMENTS IS NECESSARY, VERIFY THAT APPROVED METHODS WILL BE USED.
      13. THE SPECIAL INSPECTOR SHALL TAG OR STAMP ACCEPTED WELDMENTS WITH THE INSPECTOR'S IDENTIFICATION STAMP. APPROVED METHODS WILL BE USED.

8A. PORTIONS OF WORK REQUIRING SPECIAL INSPECTION:		YES	NO	N/A
FOUNDATION	A. COMPACTED FILL, GRADING, AND EXCAVATIONS	X		
	B. CONTINUOUS INSPECTION OF PIERS			X
CONCRETE	A. CONTINUOUS INSPECTION AND TEST CYLINDERS FOR CONCRETE.	X		
	B. CONTINUOUS INSPECTION FOR SLAB CONCRETE		X	
	C. TEST CYLINDERS FOR SLAB CONCRETE	X		
	D. ANCHOR BOLTS OR EMBEDS IN CONCRETE (INSTALLATION AND CONCRETE PLACEMENT)		X	
DRILLED IN ANCHORS	A. ALL ADHESIVE ANCHORS, RODS, DOWELS, SHALL BE CONTINUOUSLY INSPECTED DURING INSTALLATION.	X		
	B. ADDITIONAL TESTING MAY BE REQUIRED AS SPECIFIED ON THE PLANS.		X	
	C. ADHESIVE ANCHORS IN CONCRETE OR MASONRY	X		
REINFORCING STEEL	A. PLACING OF REINFORCING		X	
	B. SAMPLING AND TESTING STEEL (MILL REPORTS AND IDENTIFICATION OF STEEL)		X	
WELDING	A. ALL STRUCTURAL WELDING EXCEPT WELDING IN APPROVED SHOPS	X		
	B. ULTRASONIC TESTING OF FULL PENETRATION WELD CONNECTIONS , AND FIELD WELDS.	X		
	C. STRUCTURAL LIGHT GAGE METAL FRAME WELDING.			X
	D. REINFORCING STEEL WELDING	X		
BOLTING	A. HIGH STRENGTH BOLT A325 & A490 (TORQUE VERIFICATION)	X		
	B. HIGH STRENGTH BOLT A325N.X & A480N.X (SNUG CONTACT OF PLYS)	X		
MASONRY	A. SAMPLING OF MASONRY UNITS	X		
	B. MASONRY PRISM CONSTRUCTION	X		
	C. MORTAR SAMPLING	X		
	D. CONTINUOUS INSPECTION DURING PLACEMENT AND GROUTING OF MASONRY UNITS AND REINFORCEMENT PLACEMENT.	X		
	E. ANCHOR BOLTS OR EMBEDS IN MASONRY (INSTALLATION AND GROUT PLACEMENT)	X		
INSULATING CONCRETE FILL	A. TEST CYLINDERS AND INSPECTIONS			X
STRUCTURAL STEEL	A. MILL REPORTS AND IDENTIFICATION OF STEEL (AFFIDAVIT OF COMPLIANCE)		X	
	B. SAMPLING AND TESTING		X	
	C. DURING PLACEMENT OF PAINT AS SPECIFIED BY THE ARCHITECT.		X	
SHEAR DIAPHRAGMS	A. INSPECTION OF SHEATHING PLACEMENT AND NAIL SPACING			X
APPROVED FABRICATORS	APPROVED FABRICATORS: MUST SUBMIT CERTIFICATE OF COMPLIANCE FOR ALL OFF SITE FABRICATION SUCH AS STRUCTURAL STEEL GLU-LAMS PRECAST CONCRETE, ETC.	X		
STRUCTURAL OBSERVATION	STRUCTURAL OBSERVATIONS REQUIRED. WHEN REQUIRED BY THIS ENGINEER OR THE BUILDING DEPARTMENT, THE CONTRACTOR SHALL EMPLOY AN ENGINEER APPROVED BY THE EOR TO PERFORM STRUCTURAL OBSERVATION.	X		

METAL BUILDING SYSTEM

1. PRE-MANUFACTURED METAL BUILDING SHALL BE DESIGNED AND SEALED BY A PROFESSIONAL ENGINEER LICENSED IN THE STATE OF TEXAS AND HAVING THREE (3) OR MORE YEARS EXPERIENCE IN THE DESIGN OF THE TYPE OF THE BUILDING INDICATED ON THE CONTRACT DOCUMENTS.
2. THE METAL BUILDING AND COMPONENTS SHALL BE DESIGNED TO CARRY ITS OWN WEIGHT PLUS ALL SUPERIMPOSED DEAD AND LIVE LOADS INCLUDING WIND LOADS FROM ALL DIRECTIONS AND INCLUDING ALL MECHANICAL, ELECTRICAL AND ARCHITECTURAL LOADS. VERIFY ALL LOADS WITH MECHANICAL, ELECTRICAL AND ARCHITECTURAL PLANS.
3. VERIFY ALL DIMENSIONS AND SITE CONDITIONS PRIOR TO DESIGN, FABRICATION OR ERECTION OF PRE-MANUFACTURED BUILDINGS.
4. PRE-MANUFACTURED BUILDING FRAMES AND THE CONNECTION OF FRAME TO THE FOUNDATION TO BE DESIGNED BY OTHERS AND IS NOT THE RESPONSIBILITY OF SER CONTRACTOR SHALL COORDINATE THE CONNECTION OF THE BUILDING FRAME WITH THE SUPPLIER PRIOR TO CONSTRUCTION.
5. THIS FOUNDATION HAS BEEN DESIGNED USING ASSUMED REACTIONS FROM THE PRE-MANUFACTURED BUILDING COMPONENTS AND IS FOR BID PURPOSES ONLY. THE CONTRACTOR SHALL SUBMIT BASE CONNECTION DETAILS (SIZE AND THICKNESS BASE PLATE AND DIAMETER AND LENGTH ANCHOR BOLTS) AND REACTIONS OF THE BUILDINGFRAMES TO THE ENGINEER PRIOR TO CONSTRUCTION SO THE DESIGN ASSUMPTIONS CAN BE VERIFIED. DEPTH OF ANCHOR BOLTS SHALL BE SUFFICIENT TO PREVENT CONICAL SHEAR OF THE CONCRETE FOUNDATION.
6. METAL BUILDING SUPPLIER SHALL PROVIDE AND SUBMIT FOR REVIEW ALL DESIGN CALCULATIONS AND DRAWINGS. ALLOW TWO (2) WEEKS FOR REVIEW OF SHOP DRAWINGS.
7. ANY ADDITIONAL COST OF FOUNDATION WORK REQUIRED BY REVISIONS OF THE FOUNDATION DESIGN AFTER PRE-MANUFACTURED BUILDING REACTIONS ARE SUBMITTED SHALL BE BY OTHERS.
8. METAL ROOF DOES NOT PROVIDE LATERAL BRACING FOR THE PURLINS, BRIDGING SHALL BE DESIGNED AND SUPPLIED BY THE PURLIN MANUFACTURER.
9. REFER TO MECHANICAL DRAWINGS FOR ROOF SUPPORTED HVAC UNITS AND PROVIDE SUPPORT FOR ADDITIONAL LOADS AS REQUIRED.
10. MAXIMUM PURLIN SPACING SHALL BE 5'-0" O.C. WITH A MAXIMUM ALLOWABLE TOTAL DEFLECTION OF L/240.
11. PRE-MANUFACTURED BUILDING MANUFACTURER SHALL PROVIDE ADDITIONAL FRAMING REQUIRED TO SUPPORT THE WEIGHT MECH'L UNITS AND PROVIDE PROPER SERVICEABILITY OF SUSPENDED MECHANICAL UNITS, MECHANICAL DUCTWORK, LIGHT FIXTURES, AND ALL OTHER SUSPENDED ITEMS AND ITEMS SUPPORTED ON TOP OF ROOF.
12. DETAILS SHALL BE INCLUDED WHICH CLEARLY DETAIL RIGID FRAME BASE, HAUNCH, RIDGE PLATE CONNECTIONS AND OTHER MEMBER-TO-MEMBER CONNECTIONS.
13. WIND LOAD DESIGN SHALL INDICATE METHOD OF TRANSFERRING FORCES TO: A, END WALL WIND LOAD TO SIDE WALL FOUNDATIONS. B. AT END BAY SIDE WALL WIND LOAD TO END WALL FOUNDATIONS, CALCULATIONS SHALL SHOW HOW WIND LOAD IS TRANSFERRED TO EAVE STRUT.
14. PORTAL MOMENT FRAMES SHALL BE USED TO RESIST HORIZONTAL WIND FORCES. DESIGN OF ALL CONNECTIONS SHALL BE CLEARLY INDICATED.
15. DESIGN OF HORIZONTAL CROSS-BRACING IN PLANE OF ROOF FRAMING SHALL BE COMPLETE AND SHALL INDICATE METHOD OF TRANSFERRING TRIBUTARY WIND LOAD TO RIGID FRAMES OR THE SIDE WALL PORTAL FRAMES.
16. ALL COLUMN BASE PLATES SHALL BE SET AND GROUTED UNDER FOR FULL CONTACT BEARING.
17. ALL BASES FOR THE COLUMNS SHALL BE "PINNED" AND NOT ASSUMED AS FIXED. NO MOMENT FORCES SHALL BE TRANSFERRED INTO THE BUILDING FOUNDATION.
18. PROVIDE BUILDING CROSS SECTIONS AND ELEVATIONS WHICH CLEARLY SHOW THE PRIMARY STRUCTURAL RIGID MOMENT FRAME, PORTAL MOMENT FRAME, END WALL POST AND BEAMS, INTERIOR COLUMNS, AND OTHER STRUCTURAL MEMBERS THAT ARE TO BE USED ON THE SUBMITTED BUILDING. SIZE OF ALL STANDARD AISC MEMBERS AND OF ALL WEB AND FLANGE SECTIONS USED IN BUILT UP MEMBER SHALL BE NOTED AS WELL AS ALL BOLTS AND WELDING.
19. DESIGN AND MEMBERS FOR FRAMED OPENINGS SHALL BE PROVIDED AS PART OF THE METAL BUILDING DESIGN.
20. LATERAL SUPPORT BEAMS SHALL BE DESIGNED BY METAL BUILDING SYSTEM SUPPLIER
21. DEFLECTION CRITERIA
   a. GIRTS SUPPORTING METAL STUD WALLS L/360
   b. GIRTS SUPPORTING CMU WALLS L/480
   c. HORIZONTAL DEFLECTION OF FRAME L/360
   d. VERTICAL DEFLECTION OF FRAME L/240
   e. LATERAL SUPPORT BEAMS FOR METAL STUD WALLS L/360
   f. LATERAL SUPPORT BEAMS FOR CMU WALLS L/480

22. ALL STRUCTURAL STEEL SHALL BE FABRICATED, ERECTED, AND PAINTED IN ACCORDANCE WITH THE SPECIFICATIONS FOR THE DESIGN, FABRICATION, AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS AS AMENDED TO DATE AND THE CODE OF STANDARD PRACTICE, LATEST EDITION AS ADOPTED BY THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION, AMENDED AS FOLLOWS:
   a. SECTION 3. IN CASE OF DESCREPENCY, STRUCTURAL ENGINEERS DRAWINGS GOVERN.
   b. SECTION 4.2.1, DELETE FIRST TWO SENTENCES.
   c. SECTION 4.2.2. ANY CHANGES, ADDITIONS OR DELETIONS REQUIRER APPROVAL FROM OWNER, CONTRACTOR AND ENGINEER.
   d. SECTION 7. ALL REFERENCE TO OWNER SHALL BE CHANGED TO GENERAL CONTRACTOR.
   e. SECTION 7.9.3. THE CONTRACTOR SHALL PROVIDE THE SEQUENCE AND SCHEDULE OF CONSTRUCTION
   f. SECTION 7.9.4, THE CONTRACTOR TO DESIGN SHORES, JACKS OR LOADS.

23. STEEL SHOP SHALL BE AISC CERTIFIED AND LOCATED WITHIN 200 MILES FROM JOBSITE.

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STATE OF TEXAS
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83066
REGISTERED
PROFESSIONAL ENGINEER

10/7/2024

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ISSUED FOR: Construction

REMOTE OPERATIONS CENTER PRECINCT 1
THE COUNTY OF HIDALGO
708 E. EDINGBURG AVE. ELSA, TX 78543

PROJECT NUMBER
24286

DATE
10/7/2024

Mark	Description	Date	Appr

SHEET
S102

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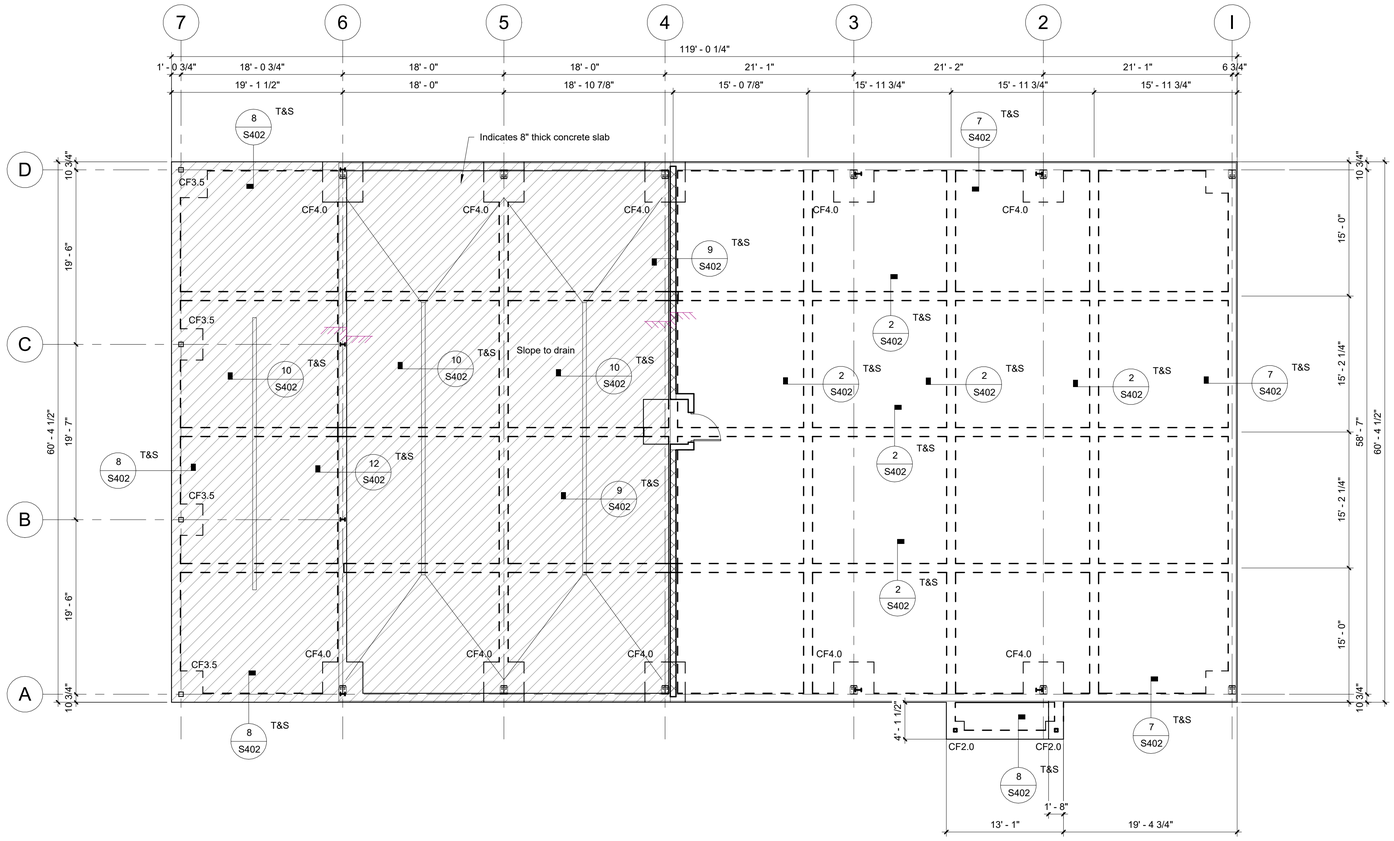
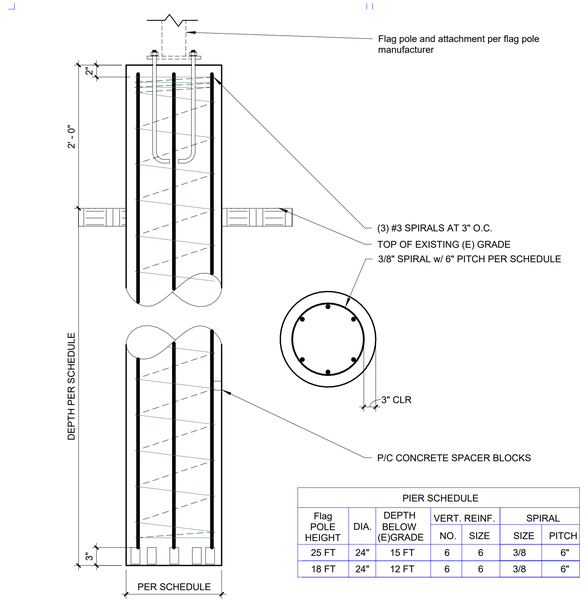


Foundation Plan 1

1/8" = 1'-0"

S201

COLUMN FOOTING SCHEDULE								
	DIMENSIONS			REINFORCING				
				A - BARS		B - BARS		
MARK	WIDTH	LENGTH	DEPTH	QUANTITY	SIZE	QUANTITY	SIZE	REMARKS
CF2.0	2' - 0"	2' - 0"	3' - 0"	3	5	3	5	
CF3.5	3' - 6"	3' - 6"	3' - 0"	4	5	4	5	
CF4.0	4' - 6"	4' - 6"	3' - 0"	5	6	5	6	



PIER SCHEDULE						
Flag POLE HEIGHT	DIA.	DEPTH BELOW (E)GRADE	VERT. REINF.		SPIRAL	
			NO.	SIZE	SIZE	PITCH
25 FT	24"	15 FT	6	6	3/8	6"
18 FT	24"	12 FT	6	6	3/8	6"

Flag Poles and Light Poles 2

1" = 1'-0"

S201

MASONRY LAYOUT NOTES

1. FOR GENERAL NOTES SEE SHEET **S101**, **S102** AND **S103**.
2. FOR TYPICAL DETAILS SEE **S400** SHEETS
3. DIMENSIONS SHOWN ARE FOR GENERAL INFORMATION. COORDINATE WITH ARCHITECTURAL PLANS.
4. SEE MECHANICAL PLANS FOR MECHANICAL OPENINGS
5. CROSS HATCH WALLS AND NON FILL WALLS SHALL BE REINFORCE AS FOLLOWS:
   AT 8" CMU WITH #6(V) AT 32" O.C. AND #5 (H) AT 96" O.C.
   AT12" CMU WITH (1) #7 AT 8" O.C. AND (2) #5 AT 96" O.C.
8. SEE DETAIL **4/S402** REINFORCING AT WINDOW, DOOR AND OPENING JAMBS.

FOUNDATION NOTES

1. FOR GENERAL NOTES SEE SHEET S101 AND S102.
2. FOR TYPICAL DETAILS SEE SHEETS NUMBER S400
3. CONTRACTOR/SUBCONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL DIMENSIONS WITH ARCHITECTURAL PLANS BEFORE COMMENCING ANY WORK. THE CONTRACTOR AND OR SUBCONTRACTOR SHALL REPORT ANY DISCREPANCIES TO THE ARCHITECT AND ENGINEER BEFORE THE WORK HAS BEGUN.
4. REFER TO ARCHITECTURAL PLANS FOR ADDITIONAL DIMENSIONS.
5. REFER TO ARCHITECTURAL PLANS FOR FLOOR DRAIN LOCATIONS.
6. SLOPE SLAB TO DRAINS, SEE ARCHITECTURAL PLANS FOR SLOPE.
7. REFER TO ARCHITECTURAL PLANS FOR FLOOR FINISHES. ENGINEER IS NOT RESPONSIBLE FOR TYPE OF FLOOR FINISHES.
8. PROVIDE SLAB CONTRACTION JOINTS PER TYPICAL DETAIL
9. THE TESTING LABORATORY SHALL BE THE OWNERS REPRESENTATIVE TO CONTROL THE PLACEMENT OF COMPACTED FILL. THE TESTING LABORATORY SHALL APPROVE THE SUBGRADE PREPARATION, THE FILL MATERIALS, THE METHOD OF PLACEMENT AND COMPACTION, AND COMPACTION, AND SHALL GIVE WRITTEN APPROVAL OF THE COMPLETED FILL. THE TESTING LABORATORY SHALL INDICATE ON THERE REPORT THE ELEVATION OF THE COMPACTED SUBGRADE.
10. ALL EARTHWORK AND GRADING SHALL BE ACCOMPLISHED IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE GEOTECHNICAL ENGINEERING STUDY. THE MORE STRINGENT REQUIREMENTS BETWEEN THESE SUBGRADE NOTES AND GEOTECHNICAL ENGINEERING STUDY SHALL GOVERN AND EXECUTED BY THE CONTRACTOR.
11. IN THE EVENT FOUNDATION EXCAVATIONS ARE CARRIED TO A DEPTH GREATER THAN REQUIRED, THE ADDITIONAL DEPTH SHALL BE FILLED WITH THE SAME CONCRETE AS THAT USED FOR FOOTING AT NO ADDITIONAL EXPENSE TO THE OWNER. NO UNCONTROLLED FILL WILL BE PERMITTED.
12. THE FOOTING EXCAVATIONS SHALL BE KEPT FREE FROM LOOSE MATERIAL AND STANDING WATER.
13. THE FOUNDATION EXCAVATIONS SHOULD BE OBSERVED BY THE TESTING LABORATORY PRIOR TO STEEL OR CONCRETE PLACEMENT TO ASSESS THAT THE FOUNDATION MATERIALS ARE CAPABLE OF SUPPORTING THE DESIGN LOADS AND ARE CONSISTENT WITH THE MATERIALS DISCUSSED IN THE STUDY. THIS IS ESPECIALLY IMPORTANT TO IDENTIFY THE ACCEPTABILITY OF THE SUBGRADE OR FILL MATERIAL UNDER THE FOOTING. SOFT OR LOOSE SOIL ZONES ENCOUNTERED AT THE BOTTOM OF THE FOOTING OR BEAM EXCAVATIONS SHOULD BE EXCAVATIONS SHOULD BE REMOVED TO THE LEVEL OF COMPETENT SOIL AS DIRECTED BY THE TESTING LABORATORY. CAVITIES FORMED AS A RESULT OF EXCAVATION OF SOFT OR LOOSE SOIL ZONES SHOULD BE BACKFILLED WITH LEAN CONCRETE OR SELECT FILL AS DETERMINED BY THE TESTING LABORATORY.
14. CARE SHOULD BE TAKEN TO SHAPE THE BUILDING AREAS SUCH THAT WATER WILL NOT POND AROUND THE STRUCTURE DURING CONSTRUCTION AND CAUSE THE NEAR SURFACE CLAYS TO SWELL. THE PROPOSED STRUCTURE SHALL BE ISOLATED FROM ANY MOISTURE SOURCE WHICH MIGHT ALSO CAUSE SWELLING OF THE CLAYS AFTER COMPLETION OF THE CONSTRUCTION.
15. WHEN THE STRUCTURE IS COMPLETE, THE GROUND SURFACE SHOULD SLOPE AWAY FROM THE STRUCTURE AND DOWN SPOUTS SHOULD CARRY RUNOFF WATER SEVERAL FEET FROM THE BUILDING, PREFERABLY INTO PAVED AREAS OR SEWERS, BEFORE DISCHARGING.
16. DO NOT PLANT, OR LEAVE IN PLACE, DEEP ROOTED TREES WITHIN CLOSE PROXIMITY TO THE PERIMETER OF THE STRUCTURE. DEEP ROOTED TREES HAVE POTENTIAL TO REMOVE MOISTURE FROM BENEATH THE BUILDING IF PLANTED CLOSE ENOUGH TO ALLOW THE ROOT BULB EXTEND NEAR OR BENEATH THE BUILDING.
17. AIR CONDITIONING CONDENSER DRAIN LINES TO DISCHARGE WATER A MINIMUM OF 5 FEET FROM THE PERIMETER OF THE STRUCTURE. THE DISCHARGE AREA SHALL HAVE SUFFICIENT SLOPE AWAY FROM THE STRUCTURE TO PREVENT STANDING WATER.
18. THE FINAL ONE (1) FOOT OF FILL OUTSIDE THE BUILDING AREA SHOULD CONSIST OF A COHESIVE CLAYEY (CL) SOIL. FILL CAN NOT BE ALLOWED TO DRY OUT DURING OR AFTER COMPACTION. (P1 BETWEEN 15 AND 25)
19. NOTE THAT SOME LEVELS OF RISK ARE ASSOCIATED WITH ALL FOUNDATION SYSTEMS AND THERE IS NO SUCH THING AS A "ZERO RISK" FOUNDATION. IT ALSO SHOULD BE NOTED THAT THE FOUNDATION PROVIDED IS NOT DESIGNED TO RESIST SOIL MOVEMENT AS A RESULT OF SEWER/PLUMBING LEAKS, EXCESSIVE IRRIGATION, NON UNIFORM IRRIGATION, POOR DRAINAGE, AND WATER PONDING NEAR THE FOUNDATION SYSTEM.
20. CONSTRUCTION FOLLOWING WET WEATHER PERIODS WILL LIKELY ENCOUNTER DIFFICULTIES DUE TO THE WET OR SOFT SURFACE SOILS BECOMING A GENERAL HINDRANCE TO EQUIPMENT DUE TO RUTTING AND PUMPING OF THE SOIL SURFACE. IF THE SUBGRADE CANNOT BE ADEQUATELY COMPACTED TO MINIMUM DENSITIES AS DESCRIBED ABOVE, ONE OF THE FOLLOWING MEASURES WILL BE REQUIRED:
    a) REMOVAL AND REPLACEMENT WITH SELECT FILL;
    b) CHEMICAL TREATMENT OF THE SOIL TO DRY SOIL AND INCREASE THE STABILITY OFTHE SUBGRADE,
    c) DRYING BY NATURAL MEANS.

SLAB ON GRADE	
THICKNESS	5.0 INCHES
REINFORCING (EACH WAY)	#4 AT 14" O.C.
REINFORCING LOCATION	MID DEPTH
VISQUEEN	15 MIL
CONCRETE CHAIRS (NO PLASTIC CHAIRS ALLOWED)	3' O.C. EACH WAY

SLAB ON GRADE, Truck Bay	
THICKNESS	7.5 INCHES
REINFORCING (EACH WAY)	#4 AT 8" O.C.
REINFORCING LOCATION	2" from top
VISQUEEN	15 MIL
CONCRETE CHAIRS (NO PLASTIC CHAIRS ALLOWED)	3' O.C. EACH WAY

SUBGRADE PREPARATION

1. SITE PREPARATION

A. PREPARATION OF EXISTING GROUND

ALL AREAS TO SUPPORT SELECT FILL SHALL BE STRIPPED OF ALL VEGETATION AND/OR ORGANIC TOPSOIL:	8	INCHES
ADDITIONAL DEPTH OF REMOVAL:	*12	INCHES
EXTEND BEYOND BUILDING FOOT PRINT:	5	FEET
EXPOSED SUBGRADE SHALL BE SCARIFIED TO A DEPTH OF:	12	INCHES
MOISTURE: (OPTIMUM MOISTURE CONTENT)	-2 TO +2%	
COMPACTION (ASTM D-698) (MAXIMUM DENSITY):	98%	

B. SELECT FILL MATERIAL

AMOUNT OF COMPACTED SELECT FILL:	32*	INCHES
NO ORGANIC OR OTHER PERISHABLE MATERIAL		
NO STONES LARGER THAN	2	INCHES

*FINISHED FLOOR SHALL BE AS INDICATED ON CIVIL DRAWINGS, INCREASE INDICATED AMOUNT OF FILL AS REQUIRED TO ACHIEVE MOST STRINGENT REQUIREMENT. INCREASE EXCAVATION AS REQUIRED TO MEET MINIMUM AMOUNT OF SELECT FILL

Select fill meet the TxDOT 2014 Standard Specification for Construction and Maintenance of Highways, Streets, and Bridges, Item 247, Flexible Base, Type A through Type E, Grades 1, 2, 3, and 5.

C. PLACING SELECT FILL

FILL LIFTS (LOOSE MEASURE, NOT EXCEEDING):	8	INCHES

D. COMPACTION OF SELECT FILL

MOISTURE: (OPTIMUM MOISTURE CONTENT)	-2 TO +2	
COMPACTION (ASTM D-698) (MAXIMUM DENSITY):	98%	

E. COMPACTION TESTING

ATTERBERG LIMITS (ONE AT A RATE OF):	5,000	CU. YDS.
COMPACTION (ONE TEST PER):	2,500	SQ. FT./ LIFT (MIN. OF 3 PER LIFT)

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708 E. EDINGBURG AVE. ELSA, TX 78543

PROJECT NUMBER
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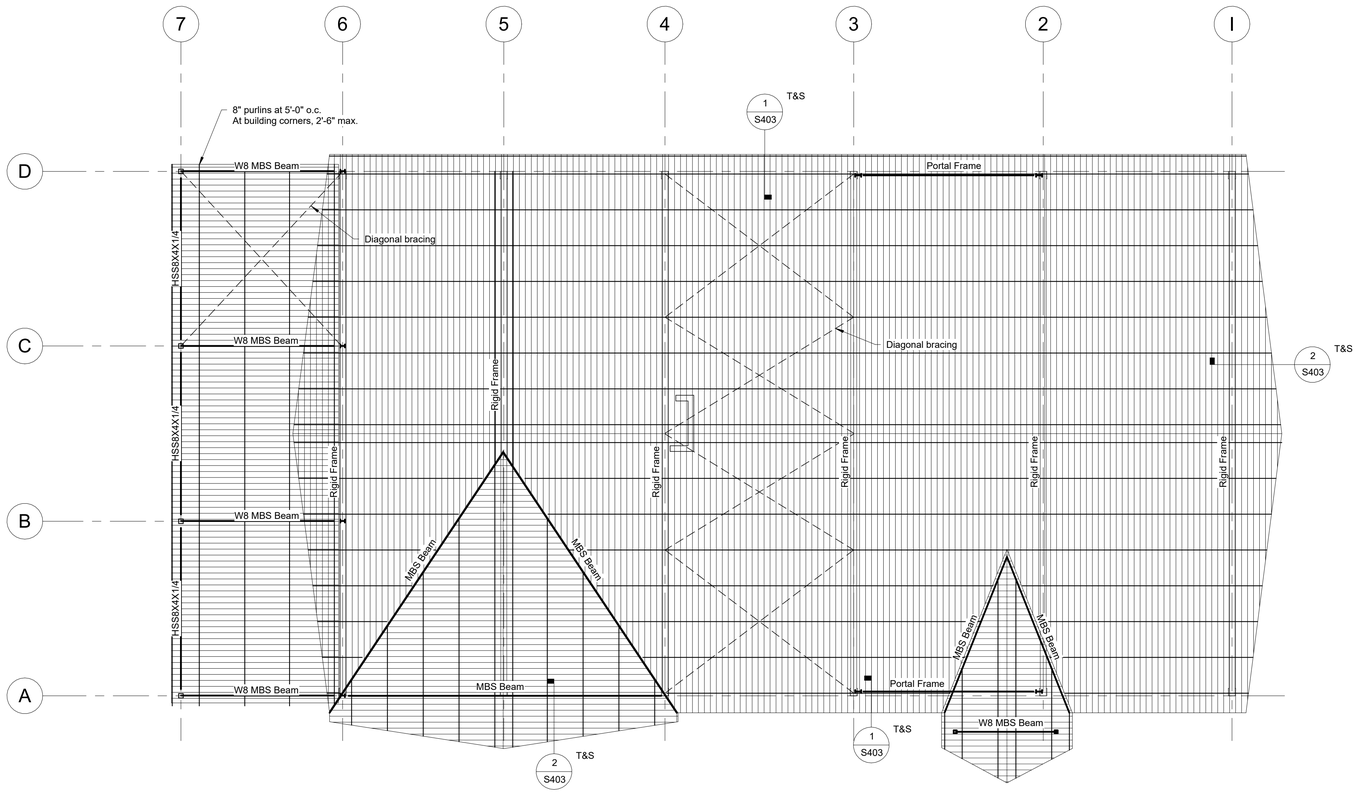

Roof Framing Plan 1
1/8" = 1'-0" S301

Framing Notes

1. FOR GENERAL NOTES SEE SHEET S101, S102 AND S103.
2. FOR TYPICAL DETAILS SEE SHEETS S400's.
3. DIMENSIONS SHOWN ARE FOR GENERAL INFORMATION. COORDINATE WITH ARCHITECTURAL PLANS.
4. SEE ARCHITECTURAL ROOF PLAN FOR ROOF HATCHES.
5. SEE MECHANICAL PLANS FOR MECHANICAL OPENINGS.
6. STEEL BEAM TO STEEL BEAM CONNECTION PER DETAIL.
7. ALL STEEL COLUMN SHALL BE HSS6x6x3/8 UNO ON PLANS.
8. PROVIDE CMU LINTEL WHERE MECHANICAL DUCT PENETRATES CMU WALL PER TYPICAL CMU LINTEL DETAIL.
9. DESIGN OF MBS PURLINS UNDER UNITS WITH LOADS INDICATED ON THE DRAWINGS PER DESIGN CRITERIA. MBS PURLINS SHALL BE DESIGNED BY MBS SUPPLIER DESIGN PURLINS FOR 1/600. (MECHANICAL WEIGHT+ DEAD LOAD ONLY) COORDINATE OPENINGS WITH MECHANICAL PLANS.
10. PURLIN MANUFACTURER TO VERIFY THE MINIMUM ROW OF BRIDGING AND SIZE.
11. PROVIDE CMU LINTEL OVER ALL OPENINGS, SEE TYPICAL CMU LINTEL DETAIL.
12. DESIGN JOISTS UNDER UNITS WITH LOADS INDICATED ON THE DRAWINGS PER DESIGN CRITERIA STEEL JOIST MANUFACTURER TO PROVIDE STEEL JOIST SIZE (MAX. JOIST DEPTH TO BE AS SHOWN ON PLANS) DESIGN JOIST FOR L/600. (MECHANICAL WEIGHT+ DEAD LOAD ONLY) COORDINATE OPENINGS WITH MECHANICAL PLANS.
13. JOIST MANUFACTURE TO VERIFY THE MINIMUM ROW OF BRIDGING AND BRIDGING SIZE, AS REQUIRED BY SJI.
14. JOISTS UNDER MECHANICAL UNITS MAY BE DOUBLED IF REQUIRED.
15. FOR OPENING IN FLOOR AND AT MECHANICAL UNITS, SEE TYPICAL DETAILS.

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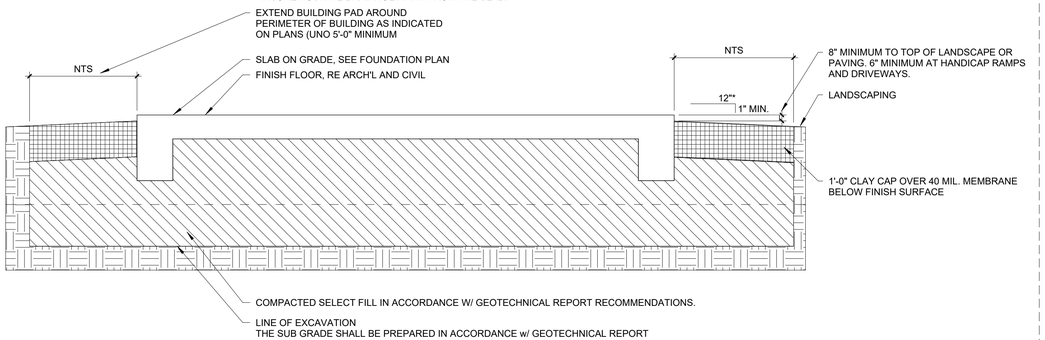
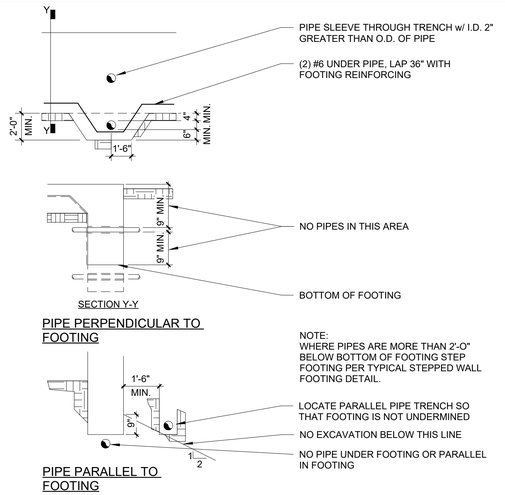
NOTE TO OWNER:
DRAINAGE OF THE SITE MUST BE MAINTAINED THROUGHOUT THE LIFE OF THE STRUCTURE. THE SOIL AT THIS SITE IS HIGHLY SENSITIVE TO CHANGE IN THE SOIL MOISTURE CONTENT AND WILL DAMAGE THE STRUCTURE IF THE MOISTURE CONTENT INCREASES OR DECREASES.

* INITIAL ROUGH GRADING SHALL BE COMPLETED w/ NATURAL CLAY MATERIALS (NO SAND ALLOWED) PRIOR TO FORM SETTING IT SHALL SLOPE 1"/ FOOT FOR THE FIRST 5', AND 6' MIN. IN 10' TO INSURE POSITIVE DRAINAGE AWAY FROM THE SLAB.

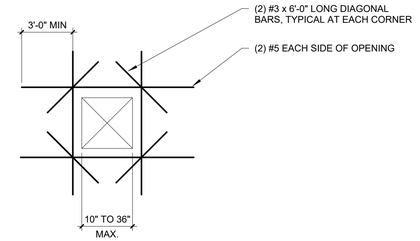
NOTE TO CONTRACTOR
PROVIDE PUMPS ON SITE AND REMOVE ANY WATER FROM THE SITE 100% OF THE TIME. STANDING WATER IN THE EXCAVATION AT ANYTIME, DAY OR NIGHT, IS UNACCEPTABLE.



Typical Building Subgrade Preparation
1" = 1'-0"
7 / S401



Typical Piping Through Footing
3/8" = 1'-0"
4 / S401



Typical Slab Opening Reinforcing
1/4" = 1'-0"
1 / S401

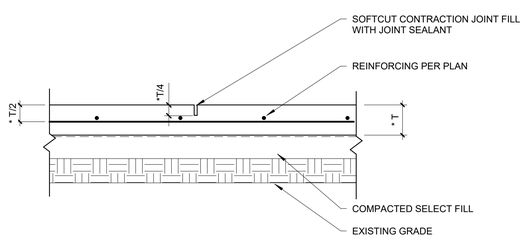
Typical Slab Construction Joint
1" = 1'-0"
8 / S401

NOTES

1. REINFORCING TO MATCH SIZE AND SPACING OF FOOTING REINFORCING.
2. SLOPE TO BE (1) VERTICAL TO (2) HORIZONTAL, EXCEPT WHERE SHOWN OTHERWISE ON PLAN.
3. FOOTING TO BE STEPPED WHERE SLOPE EXCEEDS 1:10
4. "D" INDICATES MIN. FOOTING THICKNESS.

Typical Stepped Footing
1" = 1'-0"
5 / S401

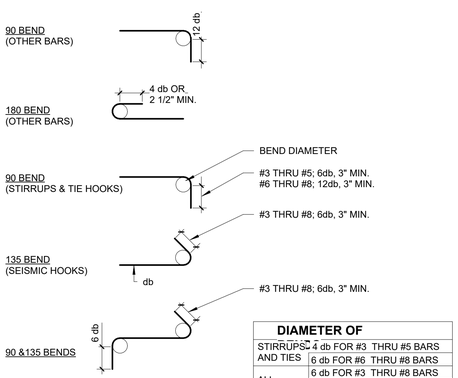
Typical Reinforcing at Concrete Intersections
1/4" = 1'-0"
2 / S401



NOTES

1. SPACING SHALL NOT EXCEED 15 FEET.
2. JOINT PATTERN SHOULD BE NEARLY SQUARE.
3. SAW CUT SHALL BE MADE WITHIN 4 HOURS OF PLACEMENT (OR AS SOON AS SLAB SURFACE CAN BE WALKED UPON WITHOUT MARKING).
4. FILL SAW CUT FULL DEPTH WITH "SKQOUR S1" AFTER SLAB IS CURED (28 DAYS, MINIMUM)
5. THIS DETAIL TO BE USED ONLY IN THE ABSENCE OF ARCHITECTURAL INFORMATION FOR CONTRACTION JOINTS

Typical Slab Contraction Joint
1" = 1'-0"
6 / S401



DIAMETER OF	
STIRRUPS AND TIES	4 db FOR #3 THRU #5 BARS
	6 db FOR #6 THRU #8 BARS
ALL OTHERS	6 db FOR #3 THRU #8 BARS
	8 db FOR #9 THRU #11 BARS
	10 db FOR #14 THRU #18 BARS

Typical Reinforcing Bends
1/4" = 1'-0"
3 / S401

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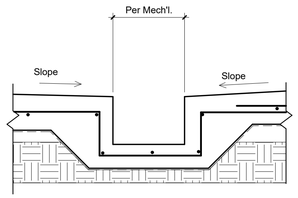
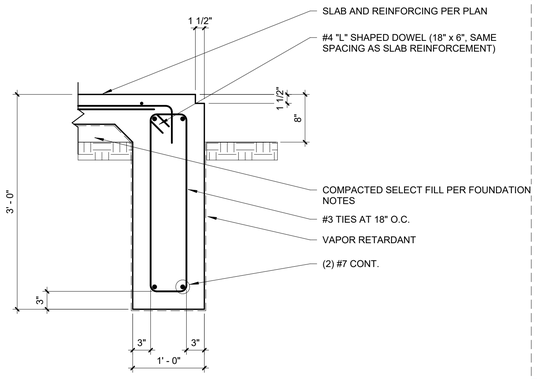
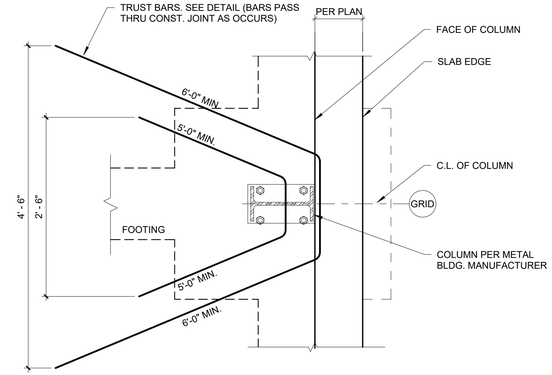


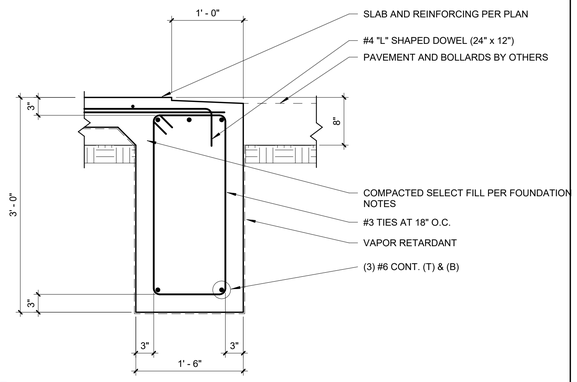
Footing at Exterior Overhead Door 16"
1" = 1'-0"
10 | S201 S402



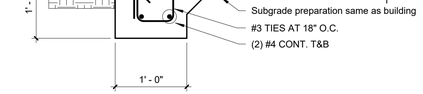
Footing at Exterior Wall at Metal Ledge
1" = 1'-0"
7 | S201 S402



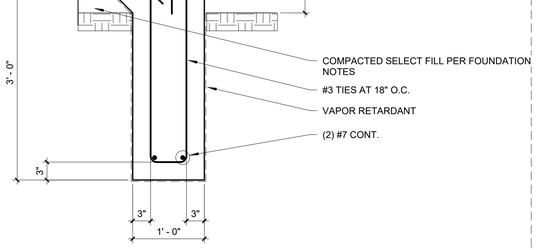
Footing at Thrust Bars at Interior Columns
1" = 1'-0"
4 | S402 S402



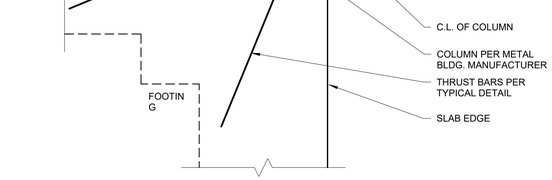
Footing at Exterior Overhead Door
1" = 1'-0"
1 | S201 S402



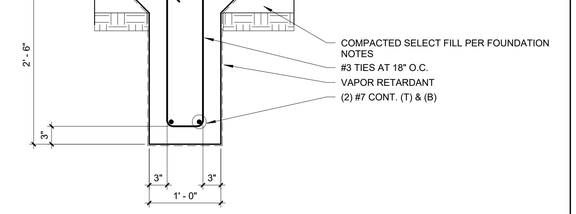
Typical Mechanical Pad
1" = 1'-0"
11 | S402



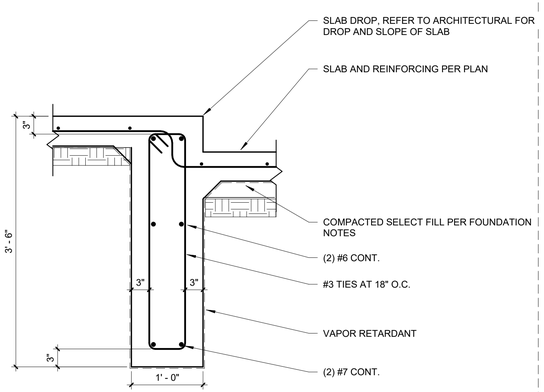
Footing at Exterior Wall at Metal Ledge
1" = 1'-0"
8 | S201 S402



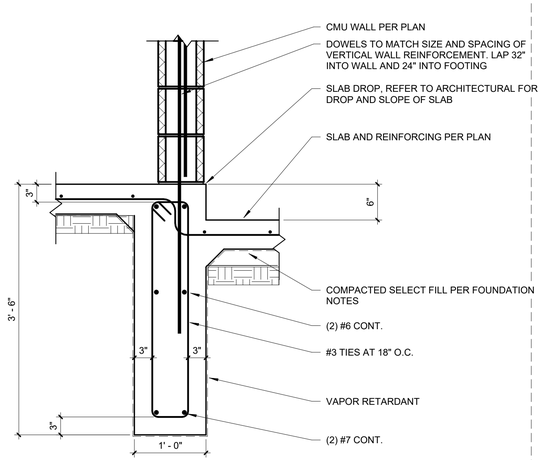
Footing at Trust Bars at Corner Columns
1" = 1'-0"
5 | S402 S402



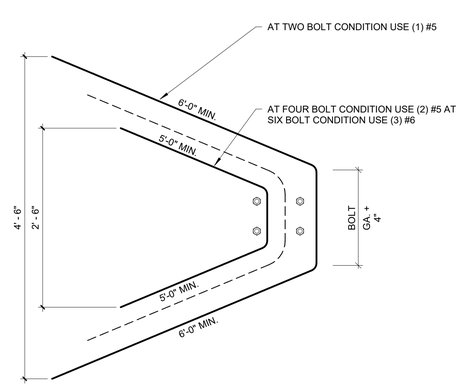
Footing at Interior
1" = 1'-0"
2 | S201 S402



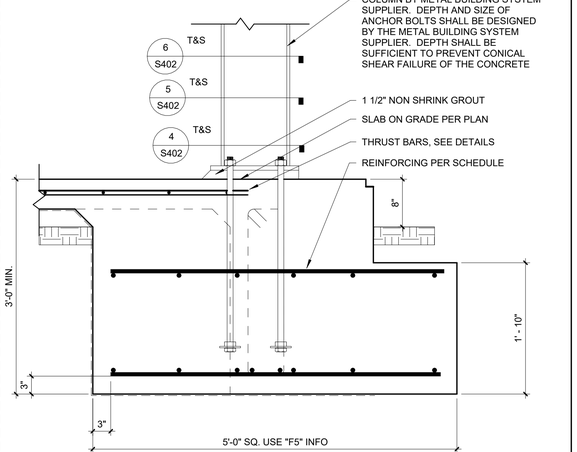
Footing at Interior 8" CMU Wall, 12"
1" = 1'-0"
12 | S201 S402



Footing at Interior 8" CMU Wall, 12"
1" = 1'-0"
9 | S201 S402



Footing Thrust Bar Detail
1" = 1'-0"
6 | S402 S402



Footing at MBS Exterior Column
1" = 1'-0"
3 | S402

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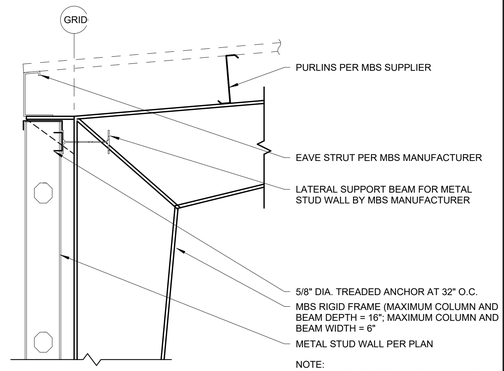
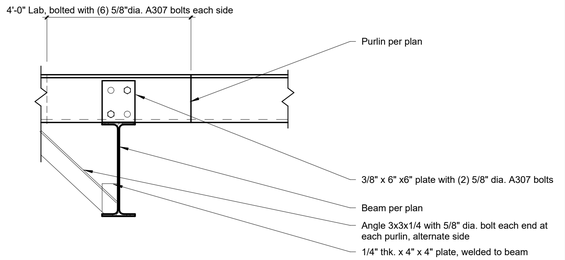


MBS to Metal Studs, Parallel
1" = 1'-0"

1
S301 S403



MBS Purlin to Frame, Interior
1" = 1'-0"

2
S301 S403

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THE COUNTY OF HIDALGO
708 E. EDINGBURG AVE. ELSA, TX 78543

PROJECT NUMBER
24286

DATE
10/7/2024

Mark	Description	Date	Appr

SHEET
S403

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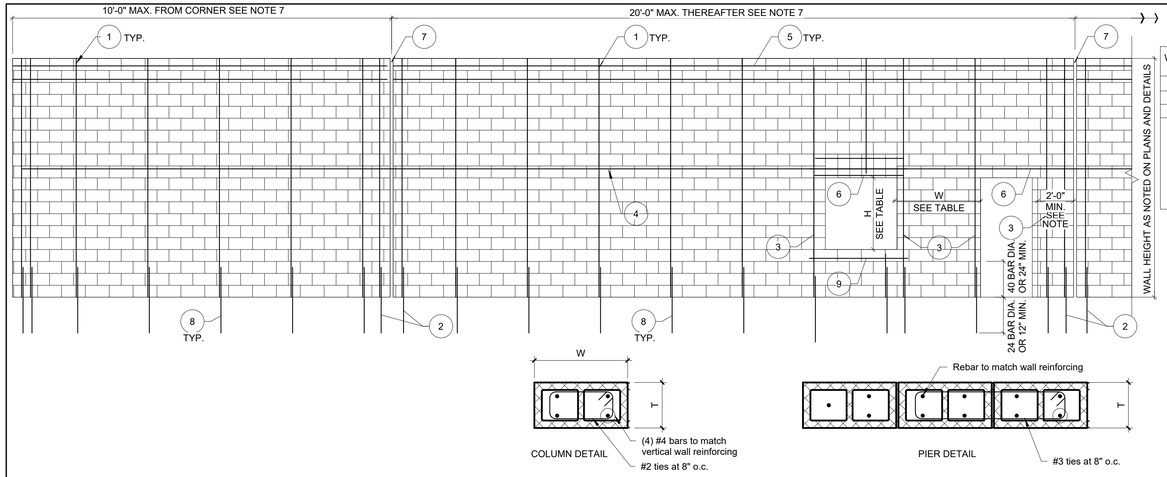

WALL THICKNESS (T)	DIMENSIONAL LIMITS		
	CLEAR	PIER	COLUMN
6"	H > 24" AND W > 32"	H > 24" AND 32" > W > 24"	H > 24" AND W < 24"
8"	H > 32" AND W > 40"	H > 32" AND 40" > W > 24"	H > 32" AND W < 24"
12"	H > 48" AND W > 64"	H > 48" AND 64" > W > 40"	H > 48" AND W < 40"

1. NORMAL WALL REINFORCING AS NOTED ON DETAILS AND DESCRIBED IN GENERAL NOTES.
2. ADDITIONAL VERTICAL REINFORCING AT CONTROL JOINTS - SEE TYPICAL CONTROL JOINT DETAIL.
3. ADDITIONAL VERTICAL REINFORCING AT JAMBS OF ALL WALL OPENINGS.
4. INTERMEDIATE BOND BEAM REINFORCED AND SPACED AS REQUIRED ON DRAWINGS. CUT ONE INTERMEDIATE BOND BEAM SHALL BE PLACED AT WINDOW LINTEL ELEVATION AND AT 8'-0" O.C.
5. ROOF LEVEL BOND BEAM REINFORCED AS NOTED ON DETAILS - CONTINUE ALL REINFORCING UNCUT THROUGH CONTROL JOINTS.
6. LINTEL REINFORCING AS DETAILED AND/OR SCHEDULED.
7. CONTROL JOINTS (CJ): UNLESS NOTED OTHERWISE ON THE ARCHITECTURAL DRAWINGS. THE CJ SPACING NOTED IS THE MAXIMUM PERMITTED. THE SPACING OF CJ'S SHALL BE COORDINATED WITH THE WALL OPENING LOCATIONS AND IN NO CASE SHALL A CJ BE LOCATED CLOSER THAN 24" TO THE JAMB OF ANY WALL OPENING.
8. FOUNDATION DOWELS TO MATCH VERTICAL WALL REINFORCING SIZE AND SPACING.
9. SILL LEVEL BOND BEAM REINFORCED AS NOTED IN MASONRY GENERAL NOTES.

Typical CMU Wall Elevation

1" = 1'-0"

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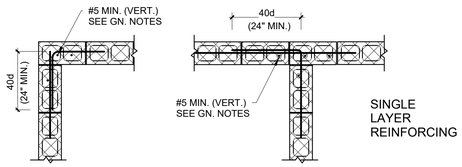
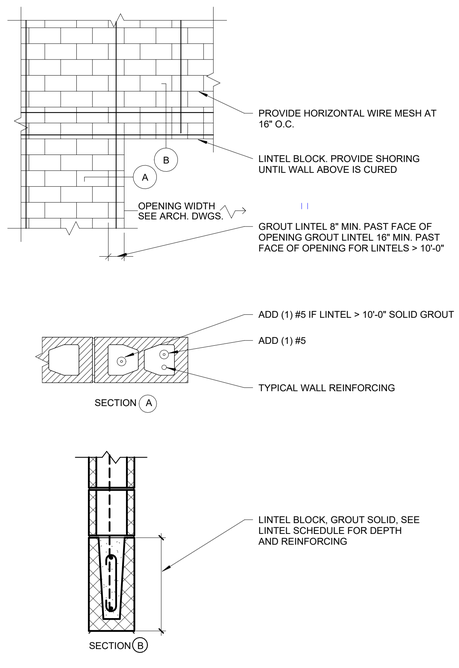


Typical CMU Reinforcing at Intersections

1/2" = 1'-0"

1 / S404

LINTEL SCHEDULE					
CLEAR SPAN	WIDTH	DEPTH	REINFORCING	#3 TIES AT:	REMARKS
<3'-4"	8"	8"	(1) #5		
<6'-6"	8"	16"	(1) #5 (T) & (B)	8"	
<10'-0"	8"	16"	(1) #6 (T) & (B)	8"	
<12'-0"	8"	24"	(1) #7 (T) & (B)	8"	
<14'-8"	8"	36"	(1) #7 (T) & (B)	8"	
<16'-0"	8"	24"	(2) #6(H) AT 8"	8"	C.I.P. CONC.
CURVED	8"	24"	(2) #6(H) AT 8"	8"	C.I.P. CONC.
24'-0"	8"	36"	(2) #6(H) AT 8"	8"	C.I.P. CONC. Extend to full lenght of wall



Typical CMU Lintel

1" = 1'-0"

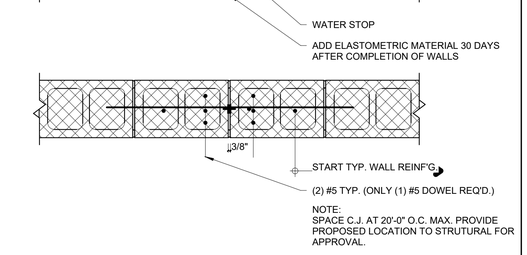
9 / S404

DIA.	EMBEDMENT		ADHESIVE
	CONCRETE	MASONRY	
1/2"	4"	6"	SIMPSON SET or HILTI HY150
5/8"	5"	6"	SIMPSON SET
3/4"	6"	6"	SIMPSON SET

Typical CMU Threaded Anchor Embedment

1" = 1'-0"

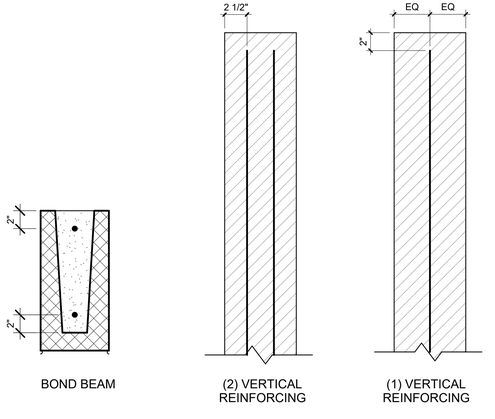
5 / S404



Typical CMU Control Joint

1" = 1'-0"

2 / S404



Typical CMU Reinforcing Clearances

1 1/2" = 1'-0"

3 / S404

Milnet Architectura Service s
AMERICAN INSTITUTE OF ARCHITECTS
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Structural Engineering
F-1616

STATE OF TEXAS
SIMON G. SOLORIO JR.
83066
REGISTERED PROFESSIONAL ENGINEER

10/7/2024

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ISSUED FOR:
Construction

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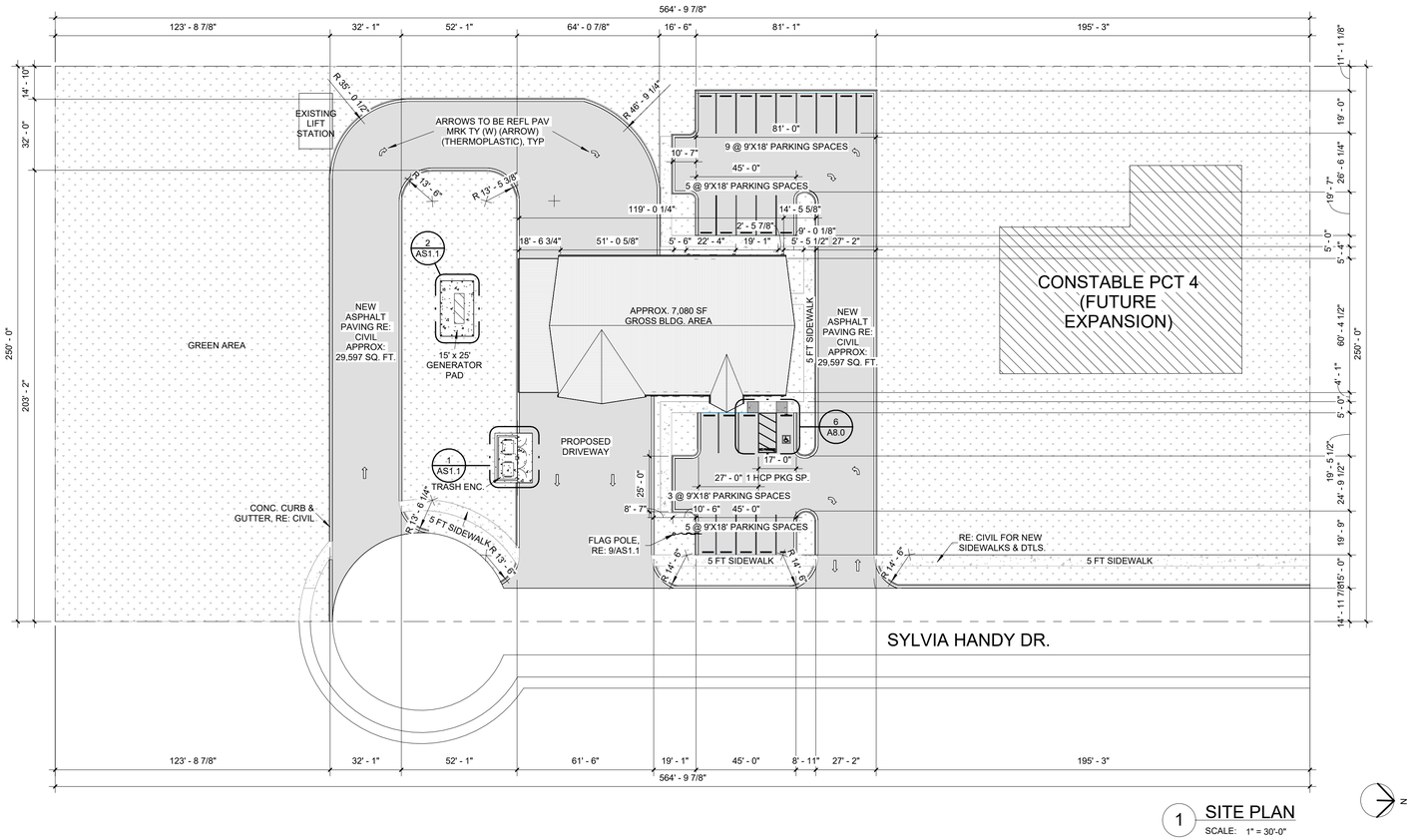

1 SITE PLAN
SCALE: 1" = 30'-0"

GENERAL NOTES:

1. OWNER WILL PROVIDE SOIL TESTS PRIOR TO FOUNDATION WORKS.

2. PROVIDE SIDEWALK AS PART OF BASE BID.

3. RE: CIVIL FOR UTILITY CONNECTIONS (U.R. WATER & SEWER)

4. WARNING:
   CONTACT 1-800-DIG TEST FOR UNDERGROUND ELECTRICAL CABLES IN SITE.

5. ALL CONSTRUCTION AND MATERIALS FOR DRAINAGE, GRADING AND PAVING TO BE IN ACCORD WITH "STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION".

6. ALL SOIL PLACED ONTO SITE IS TO BE COMPACTED TO 80% DENSITY, EXCEPT UNDER ANY PAVING COMPACTION IS TO BE 95%, BY OWNER. RE: CIVIL FOR ADDT. INFO.

7. CONTRACTOR IS RESPONSIBLE FOR ALL HORIZONTAL AND VERTICAL CONTROL FOR CONSTRUCTION.

8. CONTRACTOR IS RESPONSIBLE FOR PAYING ANY FEES FOR PERMITS AS MAY BE REQUIRED FOR THIS CONSTRUCTION.

9. ALL PIPE SLEEVES SHALL BE SCH. 40 PVC AND FURNISHED IN PLACE BY THE CONTRACTOR BEFORE PAVING.
   TUELECTRIC SLEEVES:
   6" SLEEVES ARE TO BE DOVE GREY AND PLACED 48" BELOW ROP OF CURB ELEVATIONS. WITH END CONDUIT MARKERS FURNISHED BY TUELECTRIC PLACED ON EACH END OF CONDUIT.
   IRRIGATION SLEEVES:
   2" & 4" SLEEVES ARE TO BE PLACED 24" BELOW TOP OF CURB

10. CONTRACTOR TO SET CONTROL GRADES AT 25' INTERVALS ALONG ALL PAVING FLOW LINES.

11. CONTRACTOR TO PROVIDE JOB SIGN. RE: 4/A9.0

12. PROVIDE AND INSTALL METAL CANOPY OVER NEW CONC SIDEWALKS. RE: ?/A?.?

13. ALL SIDEWALKS AND COVERED WALKWAYS SHALL HAVE 1:50 MAXIMUM CROSS SLOPE. SIDEWALKS OF COVERED WALKWAYS THAT MUST HAVE SLOPES GREATER THAN 1:20 SHALL HAVE HANDRAILS ON BOTH SIDES WITH 4" HIGH CONC. CURBS ON BOTH SIDES. HANDRAILS SHALL BE 34" TO TOP A.F.F. THERE SHALL BE NO ABRUPT CHANGE IN ELEVATION ALONG ACCESSIBLE ROUTES AT SIDEWALKS AND COVERED WALKWAYS.

14. CURB RAMP SLOPE SHALL BE 1:12 MAXIMUM WITH 1:10 FLARED SIDES AND SHALL BE TEXTURED. PAINT WITH A LIGHT REFLECTIVE PAINT. PARALLEL CURB RAMP SLOPE SHALL BE 1:12 MAXIMUM & TEXTURED. PAINT WITH A LIGHT REFLECTIVE PAINT. ALL CURB RAMPS SHALL HAVE A LANDING AT TOP & BOTTOM. LANDINGS SHALL HAVE A 1:50 MAXIMUM SLOPE IN ANY DIRECTION.

15. STRIPED ACCESS AISLES AND ACCESSIBLE PARKING SHALL HAVE A MAXIMUM CROSS SLOPE IN ALL DIRECTIONS OF 1:50.

16. ALL GRADING SHALL BE DONE TO DRAIN WATER AWAY FROM BUILDINGS.

17. ALL EXTERIOR ALCOVES SHALL HAVE A 1:50 MAXIMUM SLOPE AND SHALL HAVE NO DROPS AT DOORS NOR AT CONNECTING SIDEWALKS.

18. REFER TO CIVIL DRAWINGS. CONTRACTOR IS RESPONSIBLE FOR CONTACTING ARCHITECT IN CASE OF DISCREPANCIES AND COORDINATING WITH CIVIL ENGINEER PRIOR TO PROCEEDING.

19. PROVIDE 2' X 4' CONCRETE SPLASH BLOCK AT DOWNSPOUT LOCATIONS.

20. ALL EXTERIOR DOORS SHALL HAVE A LEVEL AREA WITH A 1:50 MAXIMUM SLOPE IN ALL DIRECTIONS. THE AREA SHALL BE A MINIMUM OF 5 FT. IN THE DIRECTION OF TRAVEL BY THE WIDTH OF THE SIDEWALK.

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SERVICES
AMERICAN INSTITUTE OF ARCHITECTS

REGISTERED ARCHITECT ... ROBERTO MILNET JR. ... 14740 ... STATE OF TEXAS

10/15/2024

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708 E. EDINGBURG AVE.
ELSA, TX 78543

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224003

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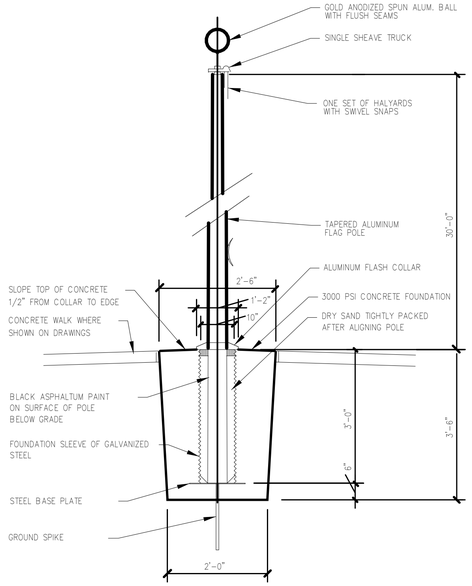
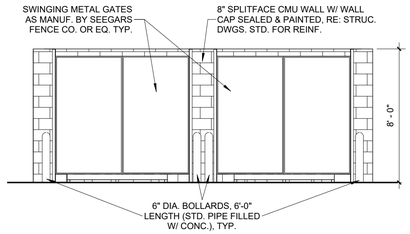
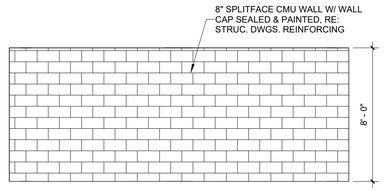
SHEET NUMBER
AS1.0



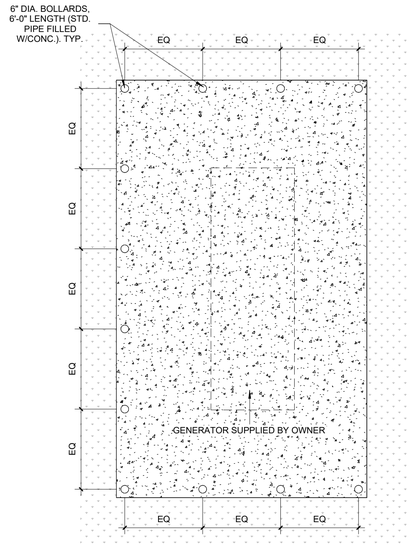
9 FLAG POLE DETAIL
SCALE: 3/4" = 1'-0"



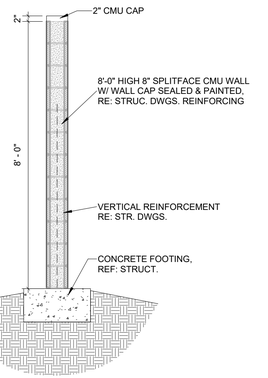
6 TRASH ENCLOSURE
SCALE: 1/4" = 1'-0"



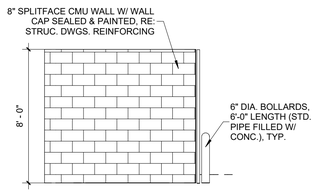
5 TRASH ENCLOSURE
SCALE: 1/4" = 1'-0"



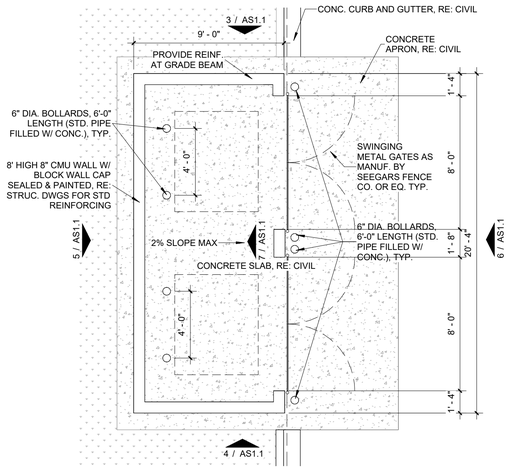
2 GENERATOR PAD PLAN
SCALE: 1/4" = 1'-0"



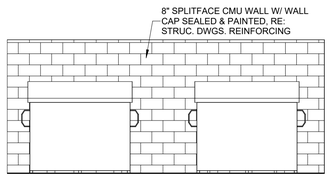
8 WALL SECTION - ENCLOSURE
SCALE: 1/2" = 1'-0"



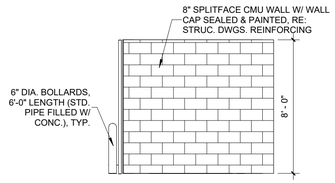
4 TRASH ENCLOSURE
SCALE: 1/4" = 1'-0"



1 TRASH ENC. PLAN
SCALE: 1/4" = 1'-0"



7 TRASH ENCLOSURE
SCALE: 1/4" = 1'-0"



3 TRASH ENCLOSURE
SCALE: 1/4" = 1'-0"

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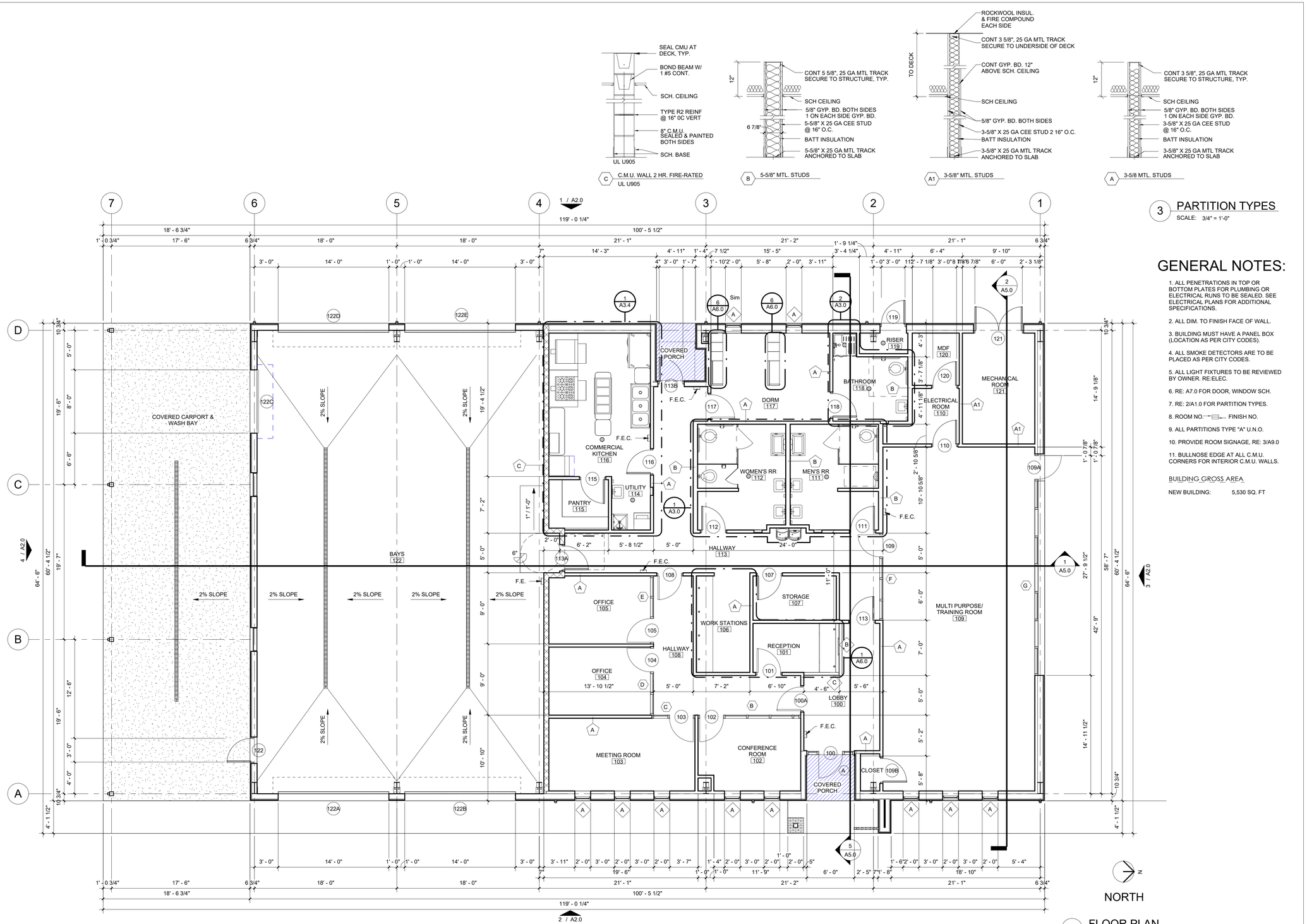

1 FLOOR PLAN
SCALE: 3/16" = 1'-0"

3 PARTITION TYPES
SCALE: 3/4" = 1'-0"

GENERAL NOTES:

1. ALL PENETRATIONS IN TOP OR BOTTOM PLATES FOR PLUMBING OR ELECTRICAL RUNS TO BE SEALED. SEE ELECTRICAL PLANS FOR ADDITIONAL SPECIFICATIONS.
2. ALL DIM. TO FINISH FACE OF WALL.
3. BUILDING MUST HAVE A PANEL BOX (LOCATION AS PER CITY CODES).
4. ALL SMOKE DETECTORS ARE TO BE PLACED AS PER CITY CODES.
5. ALL LIGHT FIXTURES TO BE REVIEWED BY OWNER. RE:ELEC.
6. RE: A7.0 FOR DOOR, WINDOW SCH.
7. RE: 2/A1.0 FOR PARTITION TYPES.
8. ROOM NO. — FINISH NO.
9. ALL PARTITIONS TYPE "A" U.N.O.
10. PROVIDE ROOM SIGNAGE, RE: 3/A9.0
11. BULLNOSE EDGE AT ALL C.M.U. CORNERS FOR INTERIOR C.M.U. WALLS.

BUILDING GROSS AREA

NEW BUILDING: 5,530 SQ. FT

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REGISTERED ARCHITECT 14740 STATE OF TEXAS

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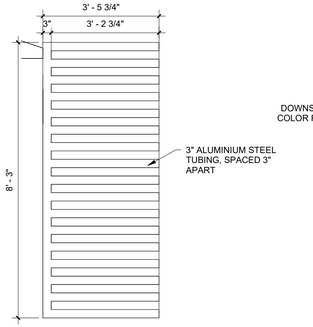
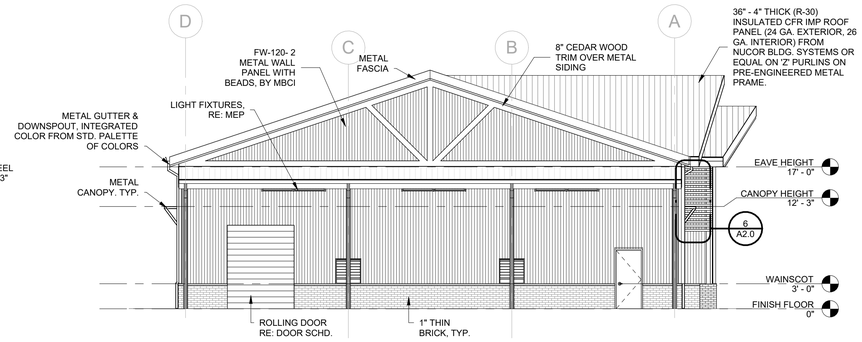


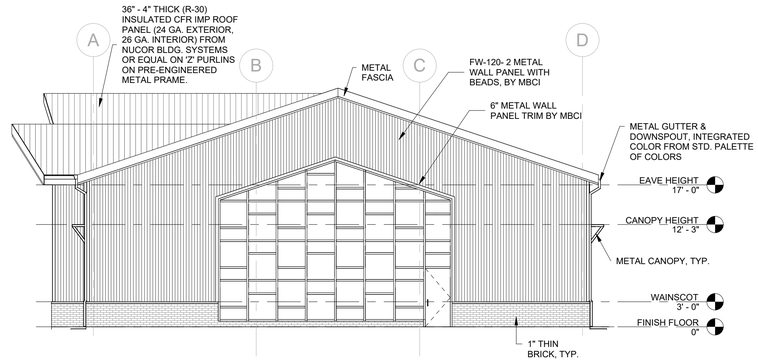
6 TUBING DETAIL

SCALE: 1/2" = 1'-0"



4 WEST ELEVATION

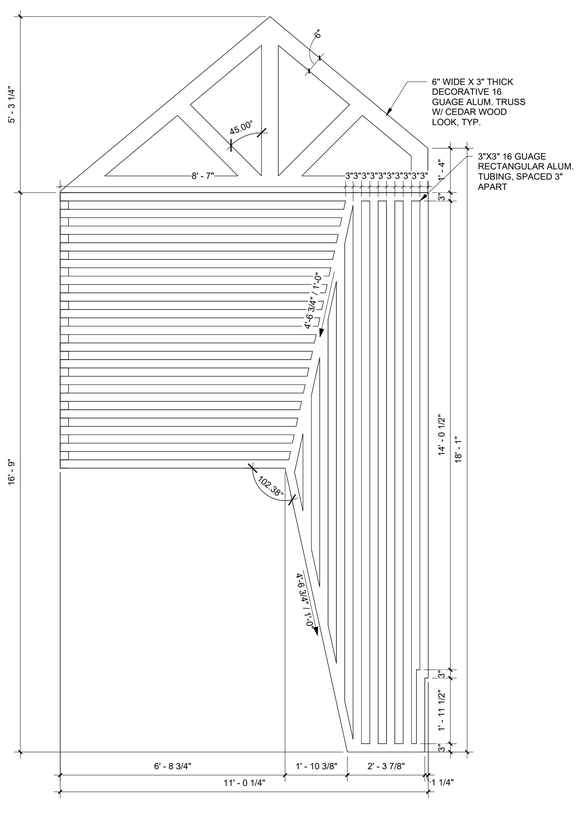
SCALE: 1/8" = 1'-0"



3 EAST ELEVATION

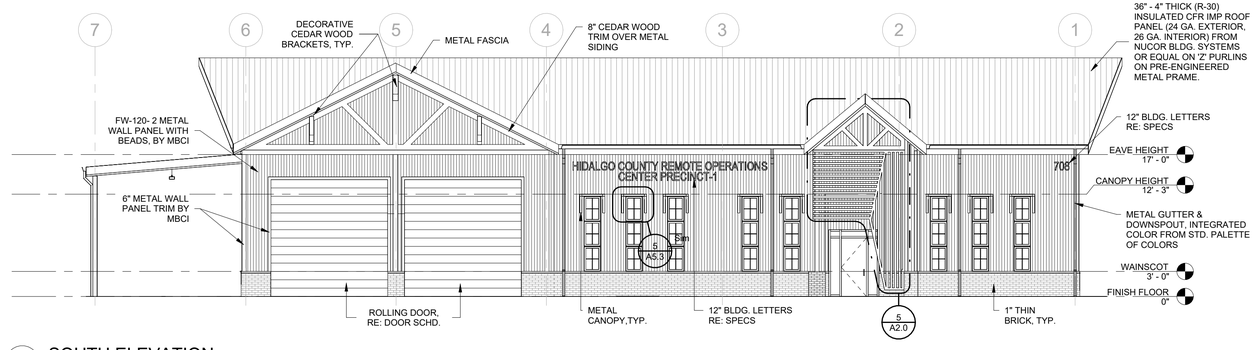
SCALE: 1/8" = 1'-0"

NOTE: METAL ELEMENTS TO BE PAINTED, COLOR TO BE SELECTED BY OWNER



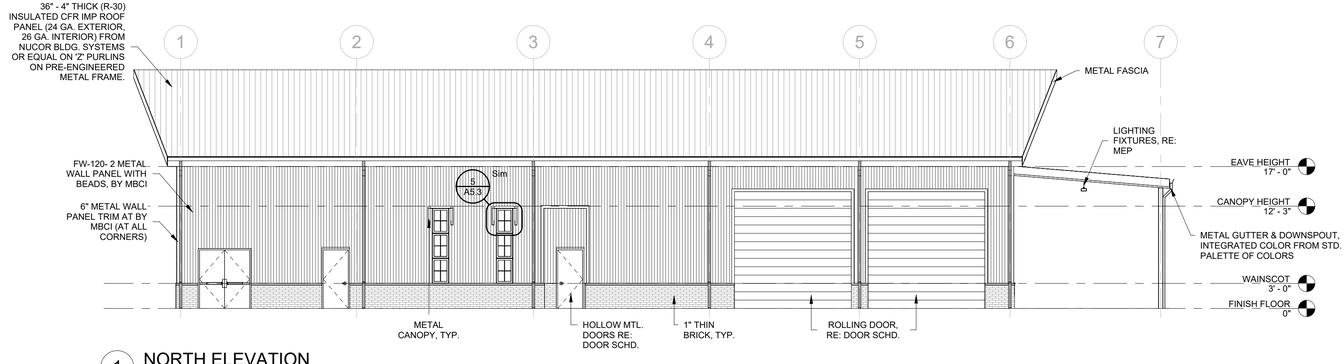
5 ENTRANCE DETAIL

SCALE: 1/2" = 1'-0"



2 SOUTH ELEVATION

SCALE: 1/8" = 1'-0"



1 NORTH ELEVATION

SCALE: 1/8" = 1'-0"

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TOILET ACCESSORIES LEGEND

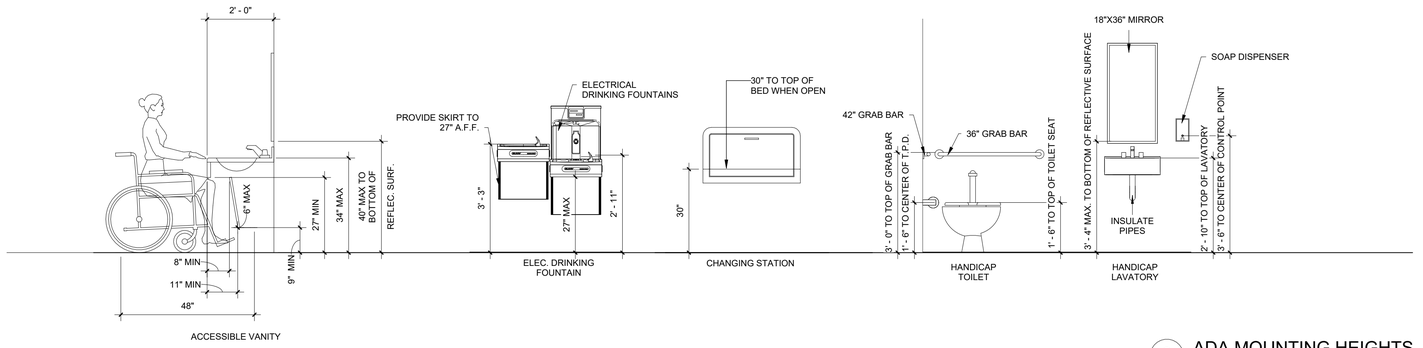
MARK	DESCRIPTION	MODEL NO.	NOTES
A	STAINLESS STL GRAB BAR 36" LONG	B-6806-36	1 & 7
B	STAINLESS STL GRAB BAR 42" LONG	B-6806-42	1 & 7
C	STAINLESS STL SHOWER GRAB BAR 18" x 36"	B-6861	1 & 7
D	NOT USED		
E	REVERSIBLE FOLDING SHOWER SEAT	B-5181	6 & 9
F	NOT USED		
G	FRAMED 1/4" PLATE GLASS MIRROR 18"x36"	B-290-1836	2 & 7
H	NOT USED		1 & 2
I	STAINLESS STL MOP & BROOM HOLDER 24" LONG	B-223-24	1 & 7
J	TOWEL HOOK	B-672	2 & 7
K	RECESSED SOAP DISH	B-4380	7 & 8
L	NOT USED		
M	RECESSED BABY CHANGING STATION. AMERICAN SPECIALTIES.	9014	3, 7 & 8
N	RECESSED PAPER TOWEL DISPENSER AND WASTE RECEPTACLE	B-369	1 & 7
P	NOT USED		1 & 2
Q	SHOWER ROD. REFER TO PLAN FOR DIMENSION	B-6107	2 & 7
R	SHOWER CURTAIN & HOOKS	B-204-1 & B-204-2 & B-204-3	7 & 8
S	NOT USED		6 & 9
T	NOT USED		3, 7 & 8
U	SURFACE MOUNTED AUTO. SOAP DISPENSER	B-2012	1 & 7
V	SURFACE MOUNTED TWO-ROLL TISSUE DISPENSER BOBRICK	B-265	1 & 2

GENERAL NOTES

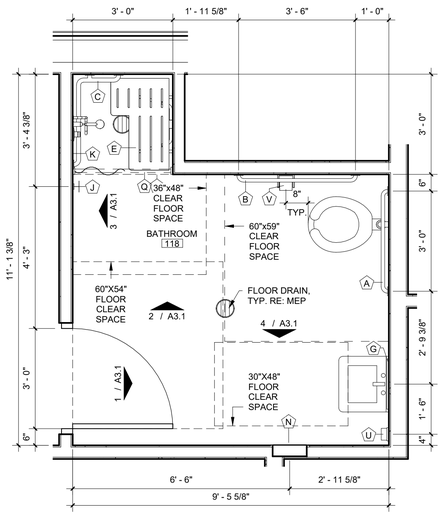
1. PROVIDE AND INSTALL NEW 8X24 CERAMIC WALL TILE WAINSCOT UP TO 6'-0" AT ALL NEW RESTROOM WALLS. REMAINING WALL HEIGHT SHALL BE TEXTURED AND PAINTED GYP. BOARD.
2. PROVIDE AND INSTALL A MOP HOLDER AT ROOM NO. 114 RE: SPECS.
3. TOILET TISSUE DISPENSER SHALL BE MOUNTED CENTERLINE 8" FROM EDGE OF TOILET RIM.
4. PROVIDE AND INSTALL A 6'-0" HIGH CERAMIC TILE WAINSCOT BEHIND MOP SINK AT ROOM NO. 114.
5. PROVIDE AND INSTALL SOLID PHENOLIC DOORS (SELF-CLOSING) AT EVERY TOILET STALL, TYP.
6. WALL TILE: REFERENCE 1/A7.3 FOR TYPICAL WALL TILE ACCENT ELEVATION DETAIL.
7. FLOOR TILE: PROVIDE AND INSTALL A BORDER COLOR WITH THREE (3) ACCENTS AND A FIELD COLOR AT EACH RESTROOM. RE: 2/A3.2 FOR FLOOR TILE LAYOUT.
8. PROVIDE AND INSTALL A FLOOR DRAIN (F.D.) AT EVERY RESTROOM, TYP.
9. ALL MOUNTING HEIGHTS FOR FIXTURES AND ACCESSORIES SHALL COMPLY WITH THE 2010 ADA AND 2012 TEXAS ACCESSIBILITY STANDARDS. COMPLIANCE SHALL BE THE CONTRACTOR'S RESPONSIBILITY.

TOILET ACCESSORIES NOTES

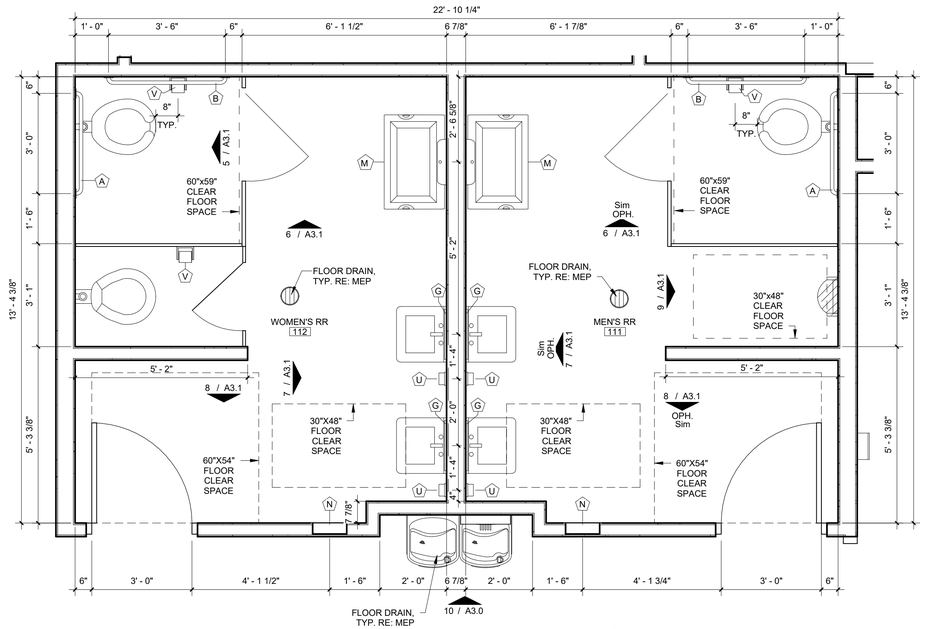
1. PROVIDE ALL NECESSARY ANCHORING PLATES AND FASTENERS.
2. PROVIDE EXPANSION SHIELDS FOR CMU PTN FOR SECURE ATTACHMENT.
3. COORDINATE WITH WALL PTN CONSTRUCTION FOR RECESSED ACCESSORY.
4. COLOR TO BE SELECTED BY ARCHITECT FROM MANUFACTURERS STANDARD COLORS.
5. COORDINATE ELECTRICAL REQUIREMENTS AND ANCHORING.
6. COORDINATE LOCATION WITH OTHER ACCESSORIES ON WALL.
7. UNIT SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR. SEE SPEC SECTION 10 21 13
   - RECESSED PTD
   - MIRRORS
   - TOILET TISSUE DISP.
   - GRAB BARS
   - SOAP DISP.
8. ALL MOUNTING HEIGHTS FOR FIXTURES AND ACCESSORIES SHALL COMPLY WITH THE 2010 ADA AND 2012 TEXAS ACCESSIBILITY STANDARDS.



3 ADA MOUNTING HEIGHTS
SCALE: 1/2" = 1'-0"



2 ENLARGED PLAN - DORM RR
SCALE: 1/2" = 1'-0"



1 ENLARGED PLAN-RESTROOMS
SCALE: 1/2" = 1'-0"

MILNET ARCHITECTURAL SERVICES
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HIDALGO COUNTY REMOTE OPERATIONS CENTER PRECINCT 1
THE COUNTY OF HIDALGO
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ELSA, TX 78543

PROJECT NUMBER
224003

DATE
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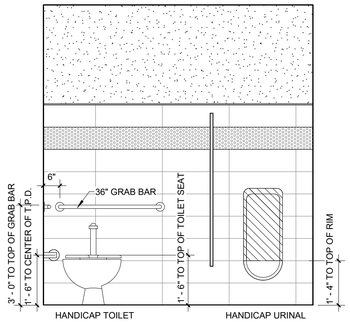
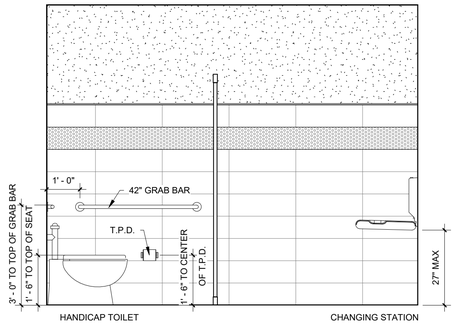
CONSTRUCTION SET

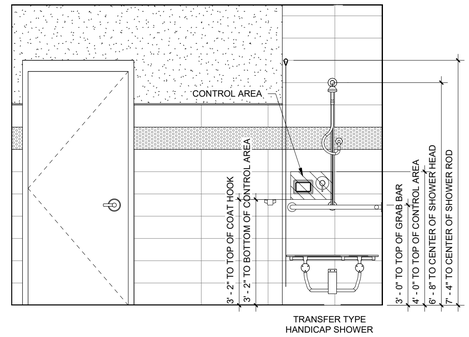
SHEET NUMBER
A3.0



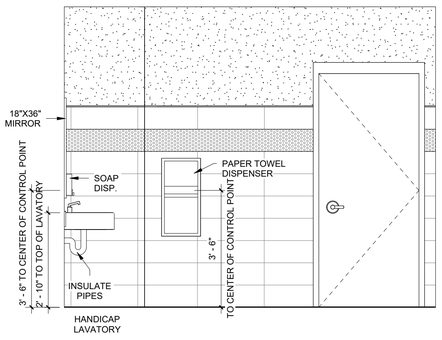
9 RESTROOM ELEVATION
SCALE: 1/2" = 1'-0"



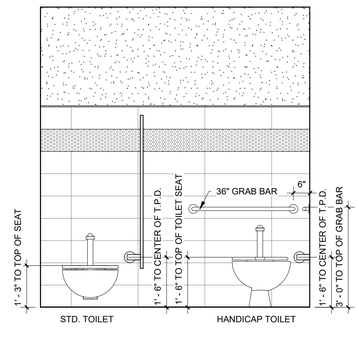
6 RESTROOM ELEVATION
SCALE: 1/2" = 1'-0"



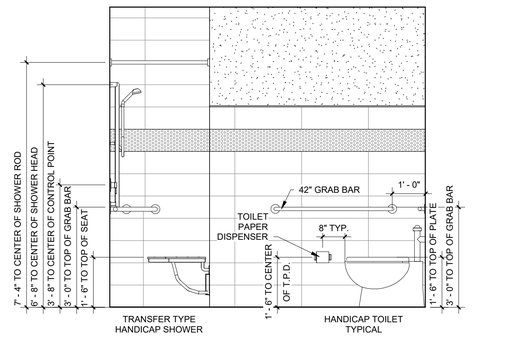
3 RESTROOM ELEVATION
SCALE: 1/2" = 1'-0"



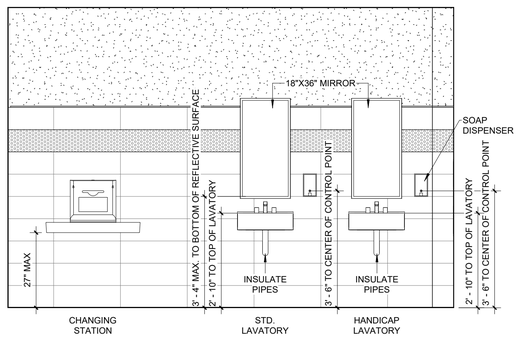
8 RESTROOM ELEVATION
SCALE: 1/2" = 1'-0"



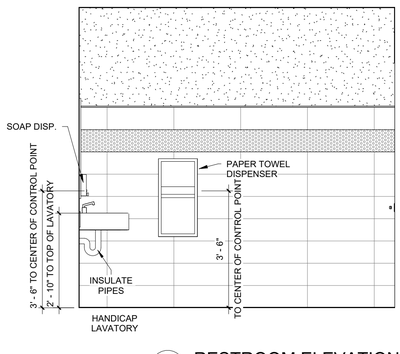
5 RESTROOM ELEVATION
SCALE: 1/2" = 1'-0"



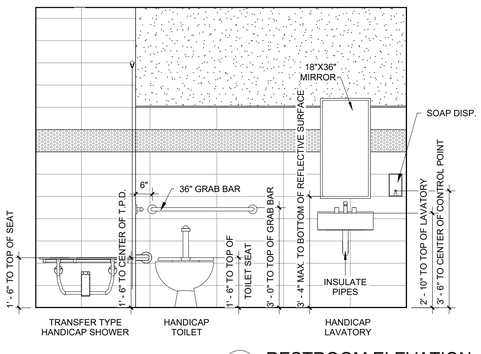
2 RESTROOM ELEVATION
SCALE: 1/2" = 1'-0"



7 RESTROOM ELEVATION
SCALE: 1/2" = 1'-0"



4 RESTROOM ELEVATION
SCALE: 1/2" = 1'-0"



1 RESTROOM ELEVATION
SCALE: 1/2" = 1'-0"

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REGISTERED ARCHITECT
RODOLFO MILNET JR.
74740
STATE OF TEXAS

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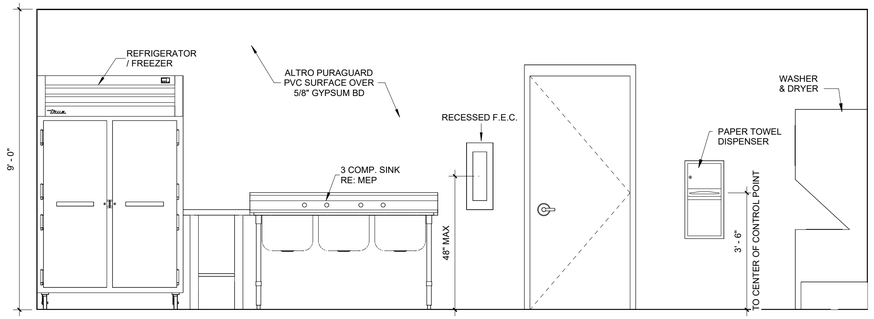
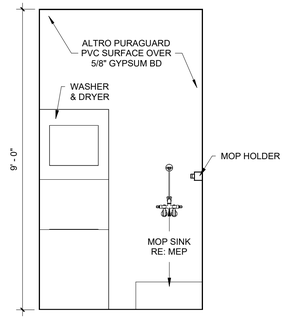


8 KITCHEN ELEVATION

SCALE: 1/2" = 1'-0"



4 UTILITY ELEVATION

SCALE: 1/2" = 1'-0"

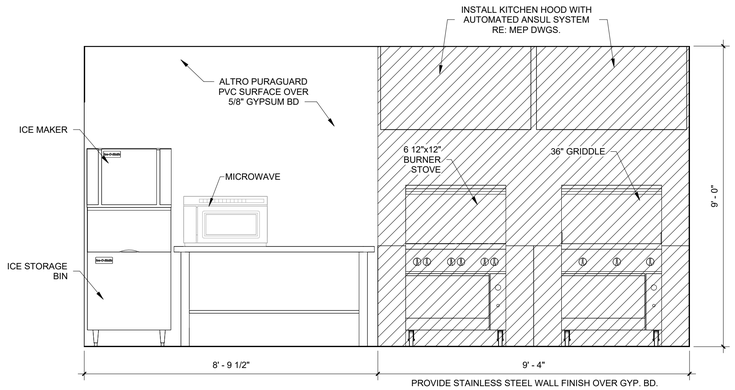
GENERAL NOTES

1. CONTRACTOR IS RESPONSIBLE FOR COORDINATING AND PROVIDING ALL MEP COMPONENTS FOR EACH PIECE OF KITCHEN EQUIPMENT. RE: MEP FOR ADDITIONAL INFORMATION.

2. CONTRACTOR SHALL PROVIDE KEYTURN CONSTRUCTION AND ENSURE ALL KITCHEN EQUIPMENT IS PROPERLY INSTALLED AND CONNECTED TO ALL REQUIRED MEP SERVICES.

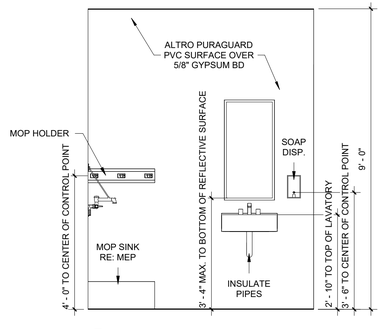
KITCHEN EQUIPMENT

ID	DESCRIPTION	NOTES
(A)	36" GRIDDLE	95,000 BTU'S
(B)	6 BURNER STOVE	215,000 BTU'S
(C)	REACH-IN SOLID SWING DOOR DUAL TEMPERATURE REFRIGERATOR/FREEZER	
(D)	ICE CUBE MAKER ICE-O-MATIC CIM2046FW/B1600-60	208/230 V - 60 HZ. - SINGLE PHASE
(E)	FOUR PAN OPEN WELL ELEC. STEAM TABLE	120 V - 60 HZ. - 2000 WATTS - SINGLE PHASE
(F)	MICROWAVE	



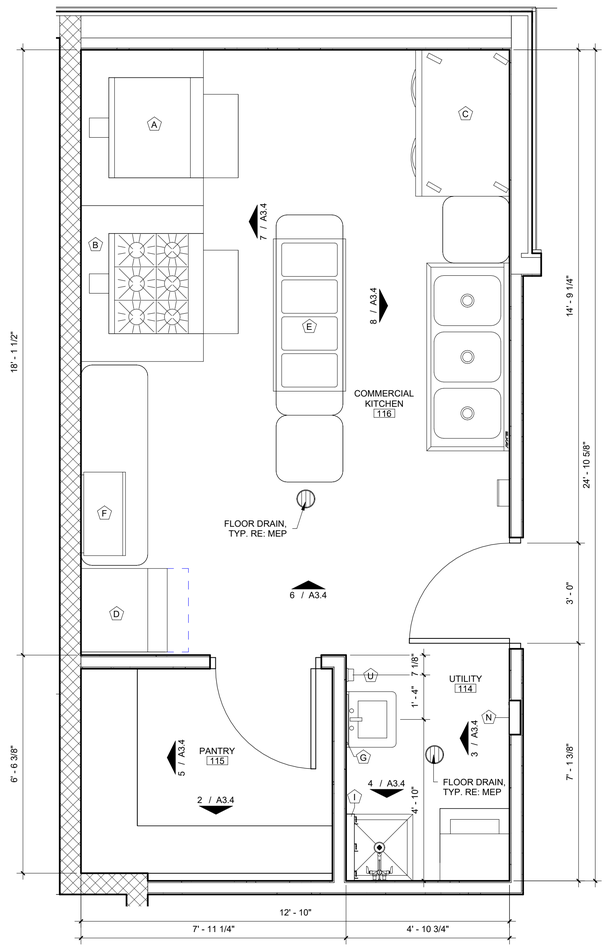
7 KITCHEN ELEVATION

SCALE: 1/2" = 1'-0"



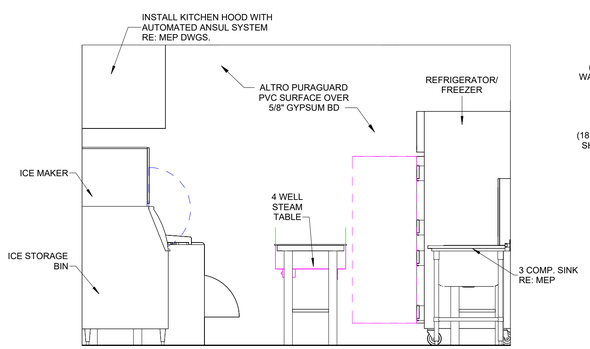
3 UTILITY ELEVATION

SCALE: 1/2" = 1'-0"



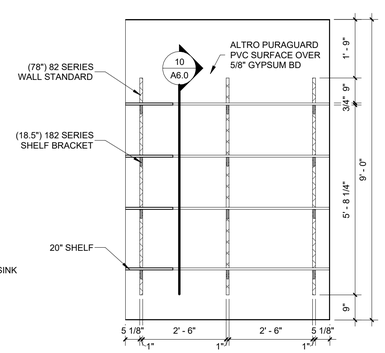
1 KITCHEN ENLARGED PLAN

SCALE: 1/2" = 1'-0"



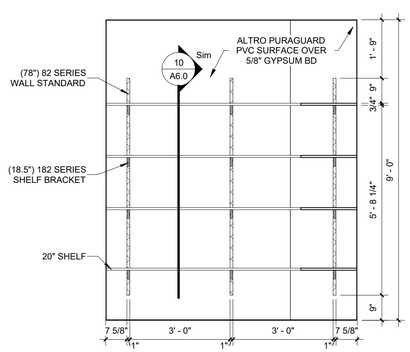
6 KITCHEN ELEVATION

SCALE: 1/2" = 1'-0"



5 PANTRY ELEVATION

SCALE: 1/2" = 1'-0"



2 PANTRY ELEVATION

SCALE: 1/2" = 1'-0"

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LEGEND

2x2 SUSPENDED CEILING

PAINTED GYPSUM BOARD

OPEN STRUCTURE. PAINTED

ARTISAN SOFFIT SYSTEM
ON METAL STUD

10' DIAMETER CEILING FAN

GENERAL NOTES:

1. ALL OUTLETS SHALL BE @ 15" A.F.F. UNLESS NOTED OTHERWISE. ALSO, OUTLETS SHALL BE PLACED 12'-0" MAX. DISTANCE ALONG INSIDE WALLS

2. GROUND FAULT INTERRUPTERS (GFI) ARE REQ'D ON CONVENIENCE OUTLETS IN RESTROOMS & KITCHEN.

3. WEATHER PROOF (W.P.) CONVENIENCE OUTLETS ARE REQUIRED OUTSIDE.

4. ALL CLG. ARE 10'-0" A.F.F. UNLESS NOTED OTHERWISE.

5. LIGHT SWITCH @ H.C. RESTROOMS @ 52" O.C.

6. RE: MEP DWGS. FOR ADDITIONAL INFO.

CONFLICTS AND DISCREPANCIES:

1. THE RELATION OF SPECIFICATIONS AND THE DRAWINGS SHALL BE EQUAL IN AUTHORITY AND PRIORITY. SHOULD THEY DISAGREE IN THEMSELVES, OR WITH EACH OTHER, BIDS SHALL BE BASED ON THE MOST EXPENSIVE COMBINATION OF QUALITY AND QUANTITY OF WORK INDICATED. THE APPROPRIATE WORK, IN THE EVENT OF THE ABOVE MENTIONED DISAGREEMENTS, SHALL BE DETERMINED BY THE ARCHITECT, AT NO ADDITIONAL COSTS TO THE OWNER.

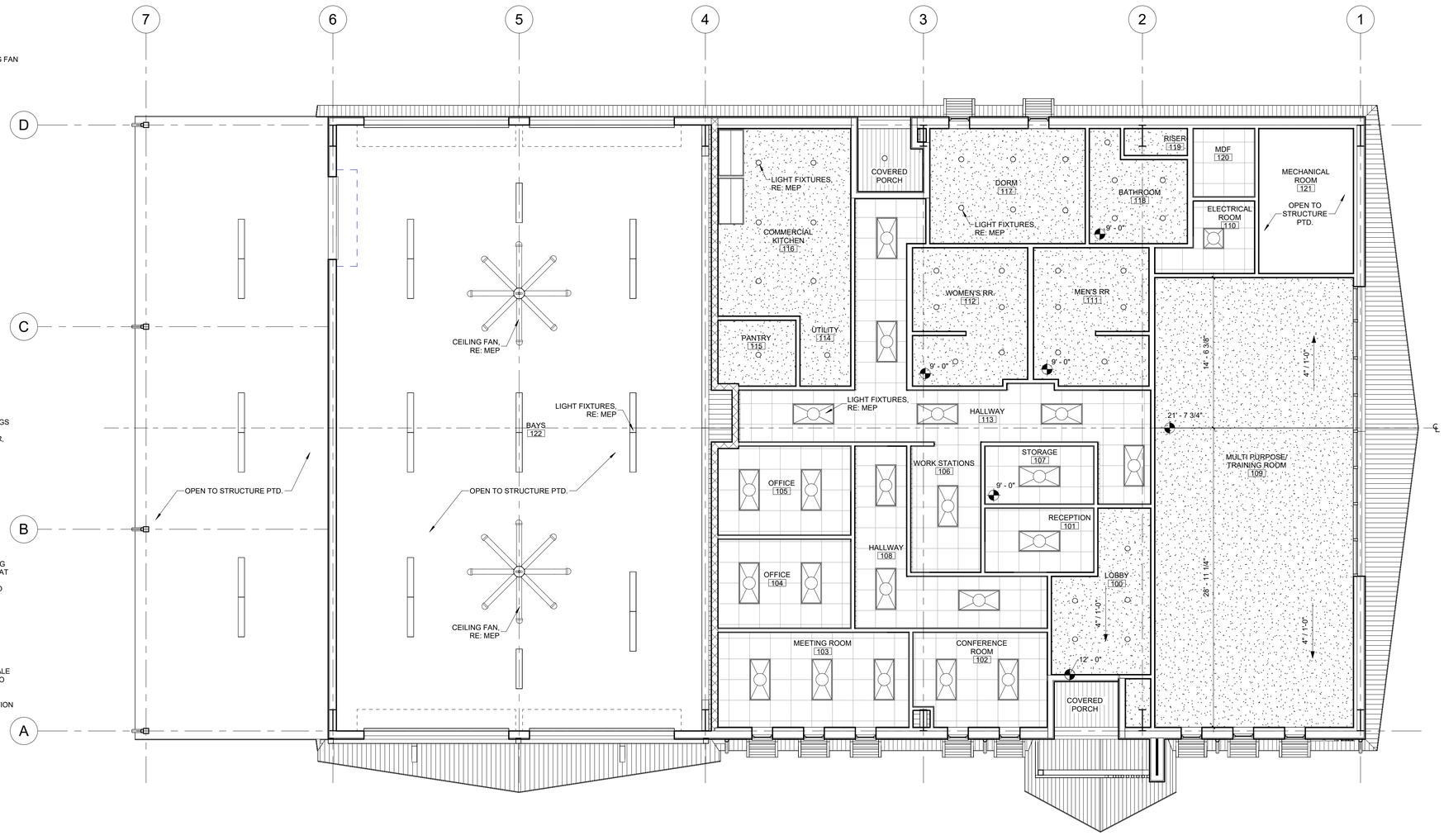
2. ANY OMISSION AND/OR CONFLICT IN THE DRAWINGS AND/OR SPECIFICATIONS, MUST BE BROUGHT TO THE ATTENTION OF THE ARCHITECT IN WRITTEN FORMAT BY R.F.I. (REQUEST FOR INFORMATION) PRIOR TO OPENING OF PROPOSALS (BIDS).

3. FAILURE TO REPORT AN OMISSION/CONFLICT IN THE DRAWINGS AND/OR SPECIFICATIONS, PRIOR TO OPENING OF PROPOSALS (BIDS) SHALL BE DEEMED EVIDENCE THAT THE CONTRACTOR HAS ELECTED TO PROCEED IN THE MORE EXPENSIVE MANNER, AT NO ADDITIONAL COST TO THE OWNER.

INTENT OF DRAWINGS:

1. THE DRAWINGS ARE DIAGRAMMATIC AND SMALL SCALE ONLY. THEY CONVEY THE INTENT OF THE WORK BUT DO NOT SHOW EVERY SINGLE CONSTRUCTION DETAIL.

2. CONTRACTOR IS RESPONSIBLE, AS THE CONSTRUCTION EXPERT, TO PROVIDE AND INSTALL ALL NECESSARY MATERIALS, COMPONENTS AND SYSTEMS NECESSARY FOR THE TURN KEY CONSTRUCTION OF THE PROJECT.



1 REFLECTED CEILING PLAN
SCALE: 3/16" = 1'-0"

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RODOLFO MILNET JR.
74740
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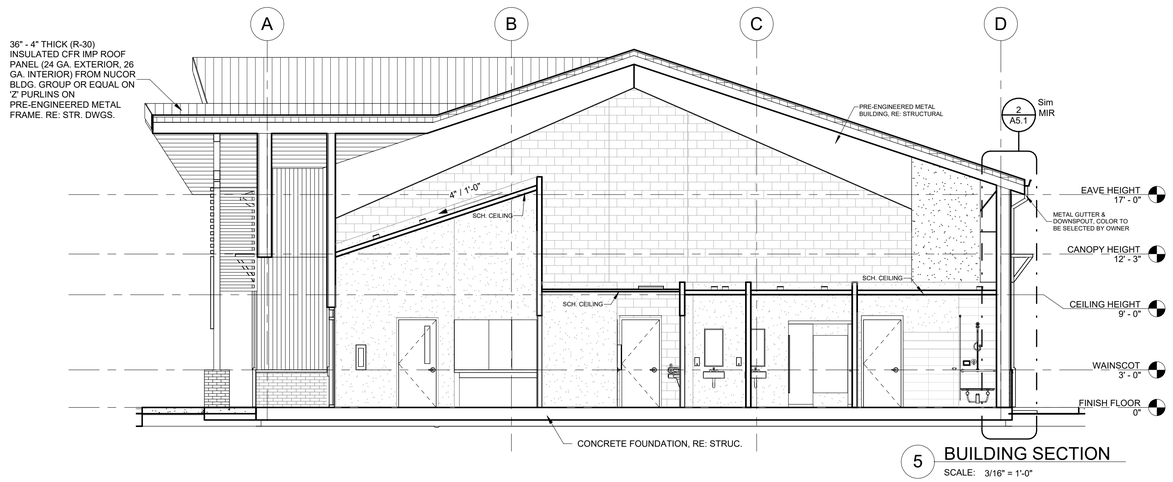
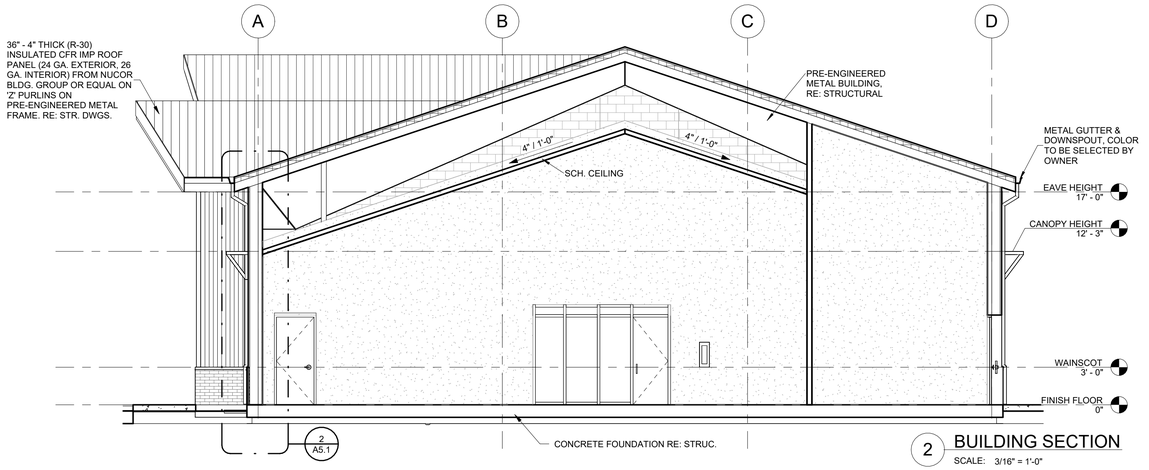


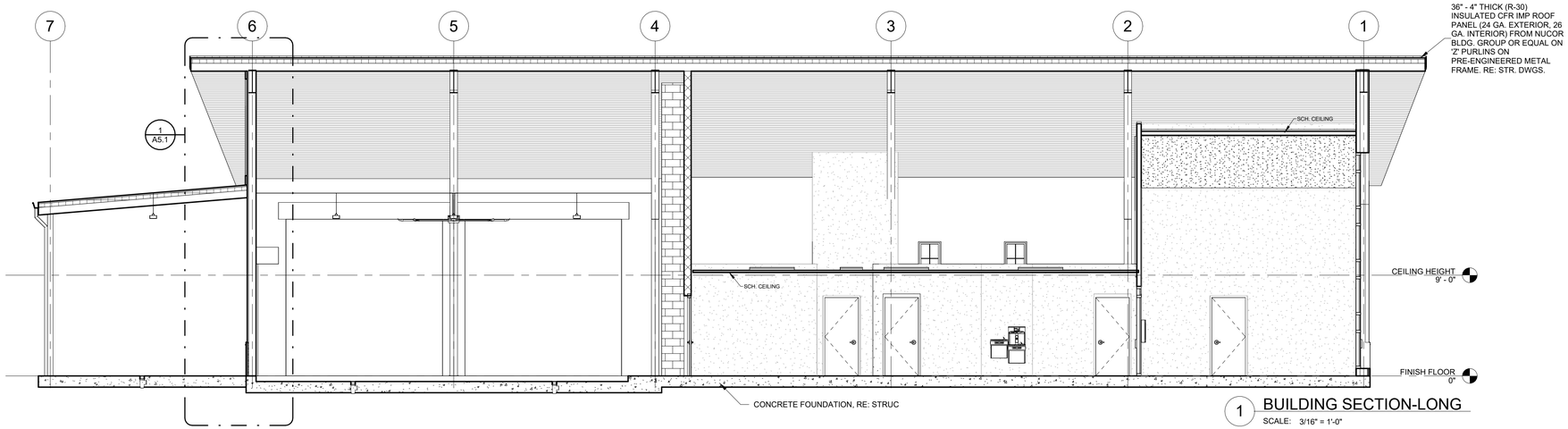
5 BUILDING SECTION

SCALE: 3/16" = 1'-0"



2 BUILDING SECTION

SCALE: 3/16" = 1'-0"



1 BUILDING SECTION-LONG

SCALE: 3/16" = 1'-0"

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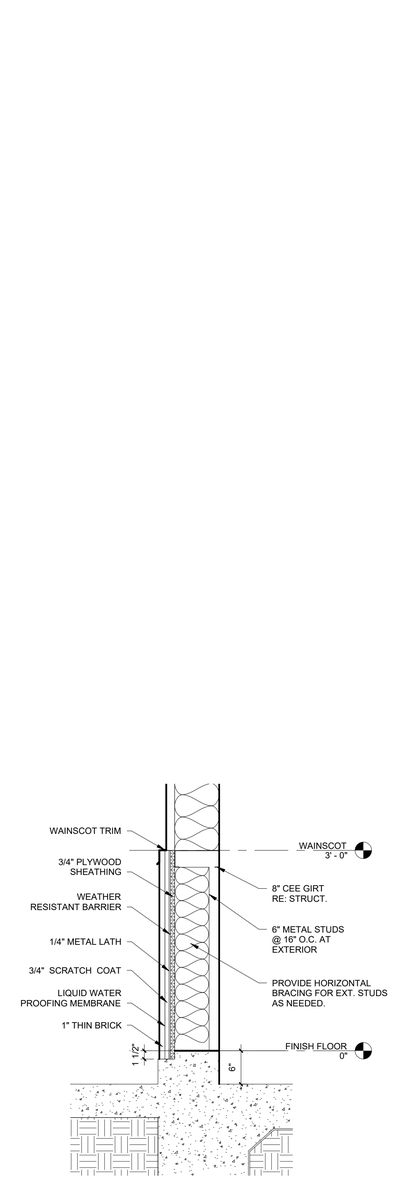
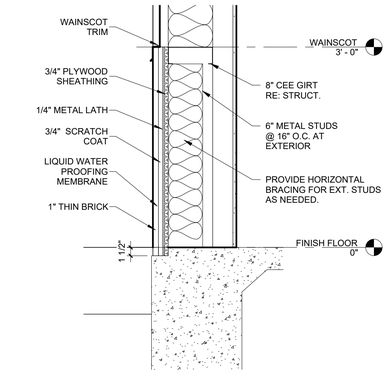


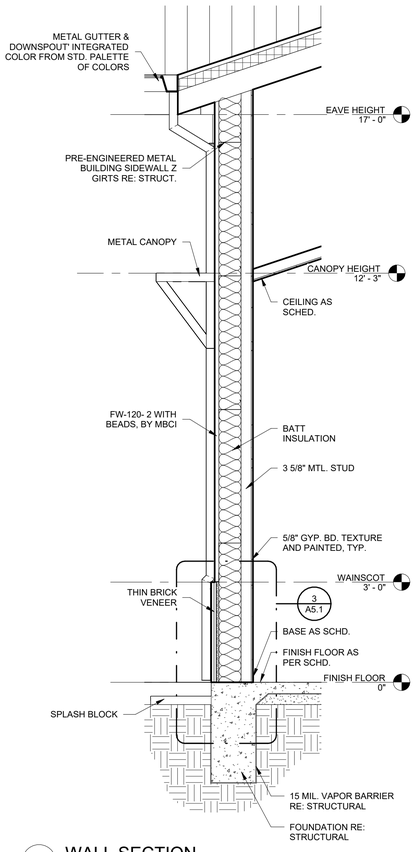
4 THIN BRICK SECTION

SCALE: 1" = 1'-0"



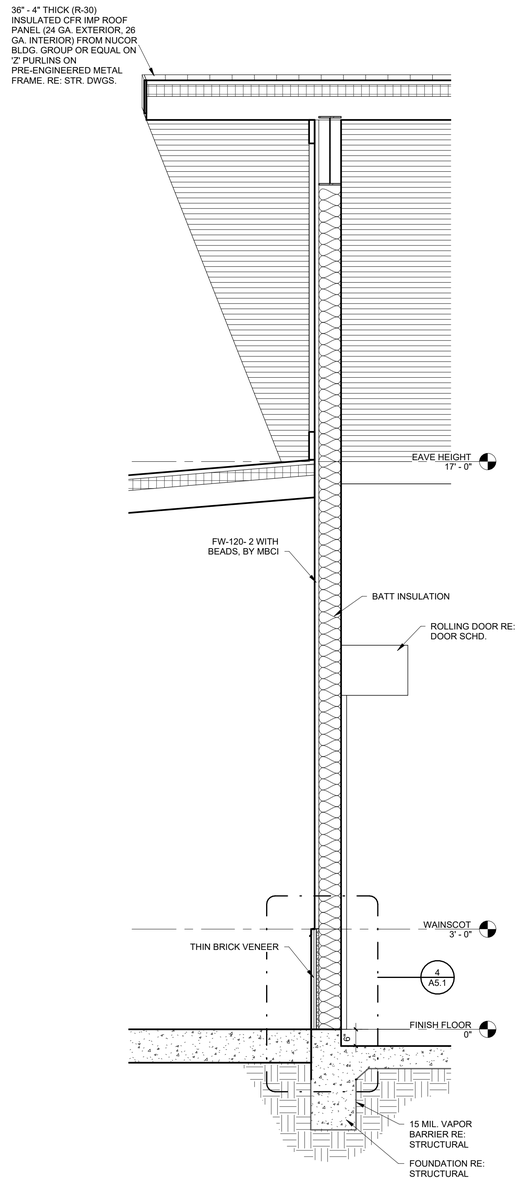
3 THICK BRICK SECTION

SCALE: 1" = 1'-0"



2 WALL SECTION

SCALE: 1/2" = 1'-0"



1 WALL SECTION

SCALE: 1/2" = 1'-0"

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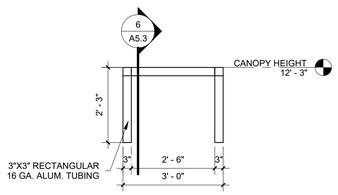
GENERAL NOTES:

1. GENERAL CONTRACTOR SHALL VISIT SITE TO INSPECT EXIST. CONDITIONS WITH REGARD TO THE SCOPE OF WORK PRIOR TO BIDDING PROJECT. IMMEDIATELY NOTIFY ARCHITECT, IN WRITING, OF ANY AMBIGUITIES FOR CLARIFICATION.
2. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD-VERIFY EXISTING CONDITIONS, DIMENSIONS, QUANTITIES, ETC. PRIOR TO BIDDING.
3. ALL EXISTING ITEMS TO REMAIN OR BE RELOCATED SHALL BE PROTECTED FROM DAMAGE DURING CONSTRUCTION. ALL EXISTING ITEMS TO REMAIN WHICH ARE DAMAGED DURING CONSTRUCTION SHALL BE REPAIRED OR REPLACED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER, AS DIRECTED BY ARCHITECT.
4. ALL SURFACES, INCLUDING WALLS AND CONCRETE WALKS, MUST BE PROTECTED FROM WELDING SPARK, PAINT, ASPHALT AND OTHER MATERIALS OR OBJECTS WHICH MAY DAMAGE ANY SURFACES. DAMAGED SURFACES SHALL BE REPAIRED OR REPLACED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER, AS DIRECTED BY THE ARCHITECT.
5. AT NO TIME DURING THE PROCESS OF THE WORK SHALL THE CONTRACTOR INTERRUPT THE CONTINUITY OF ANY OF THE REQUIRED SERVICES TO THE EXISTING BUILDINGS DURING REGULARLY SCHEDULED USAGE BY THE OWNER. ANY DAMAGE TO THESE SERVICES SHALL BE REPAIRED BY THE CONTRACTOR AT NO COST TO THE OWNER.
6. CONTRACTOR TO LEGALLY DISPOSE OF ALL CONTRUSCTION DEBRIS, EXTRA MATERIALS & DEMOLISHED ITEMS.
7. AT NEW ROOF AREAS, WALK THROUGH EVERY ROOM IN BUILDING WITH THE OWNERS REPRESENTATIVE & IDENTIFY & LOCATE WATER DAMAGED CEILINGS, WALLS, ETC. TO DETERMINE LOCATION & AMOUNTS OF INTERIOR WATER DAMAGE PRIOR TO BEGINNING WORK. MAIL COPY OF THIS LIST TO OWNER & ARCHITECT. VIDEO TAPE IS ACCEPTABLE.
8. THE PORTION OF THIS PROJECT HAS BEEN DESIGNED TO BE IN COMPLIANCE WITH ALL APPLICABLE CODES, INCLUDING BUT NOT LIMITED TO THE INTERNATIONAL BUILDING CODE - 2018. THE SPECIFIED ROOFING SYSTEM MEETS FACTORY MUTUAL RESEARCH CORP. STANDARD 4470 APPROVAL REQUIREMENTS FOR CLASS 1 FIRE AND 1-90 WINDSTORM CLASSIFICATION.
9. CONTRACTOR TO REVIEW M.E.P. DRAWINGS FOR LOCATIONS OF NEW ROOF TOP EQUIPMENT & PENETRATIONS.

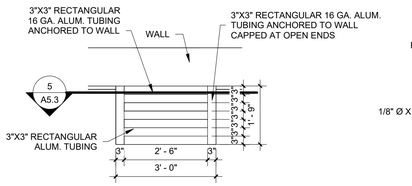
SCOPE OF WORK

A. INSTALL SPECIFIED ROOF INSULATION SYSTEM AND AS INDICATED ON THE PLANS.

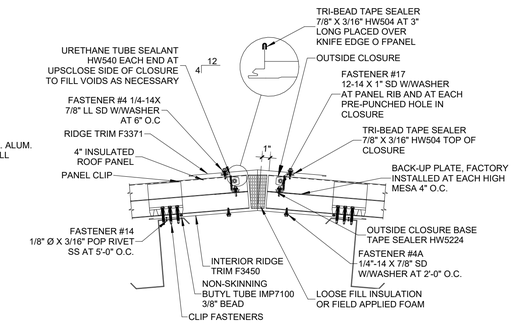
B. INSTALL ALL FLASHING AND SHEET METAL COMPONENTS



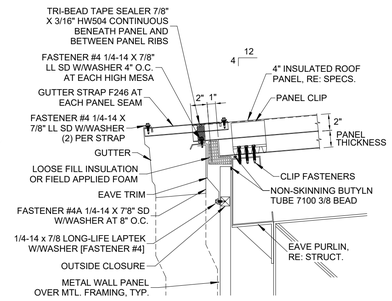
5 CANOPY ELEV.
SCALE: 1/2" = 1'-0"



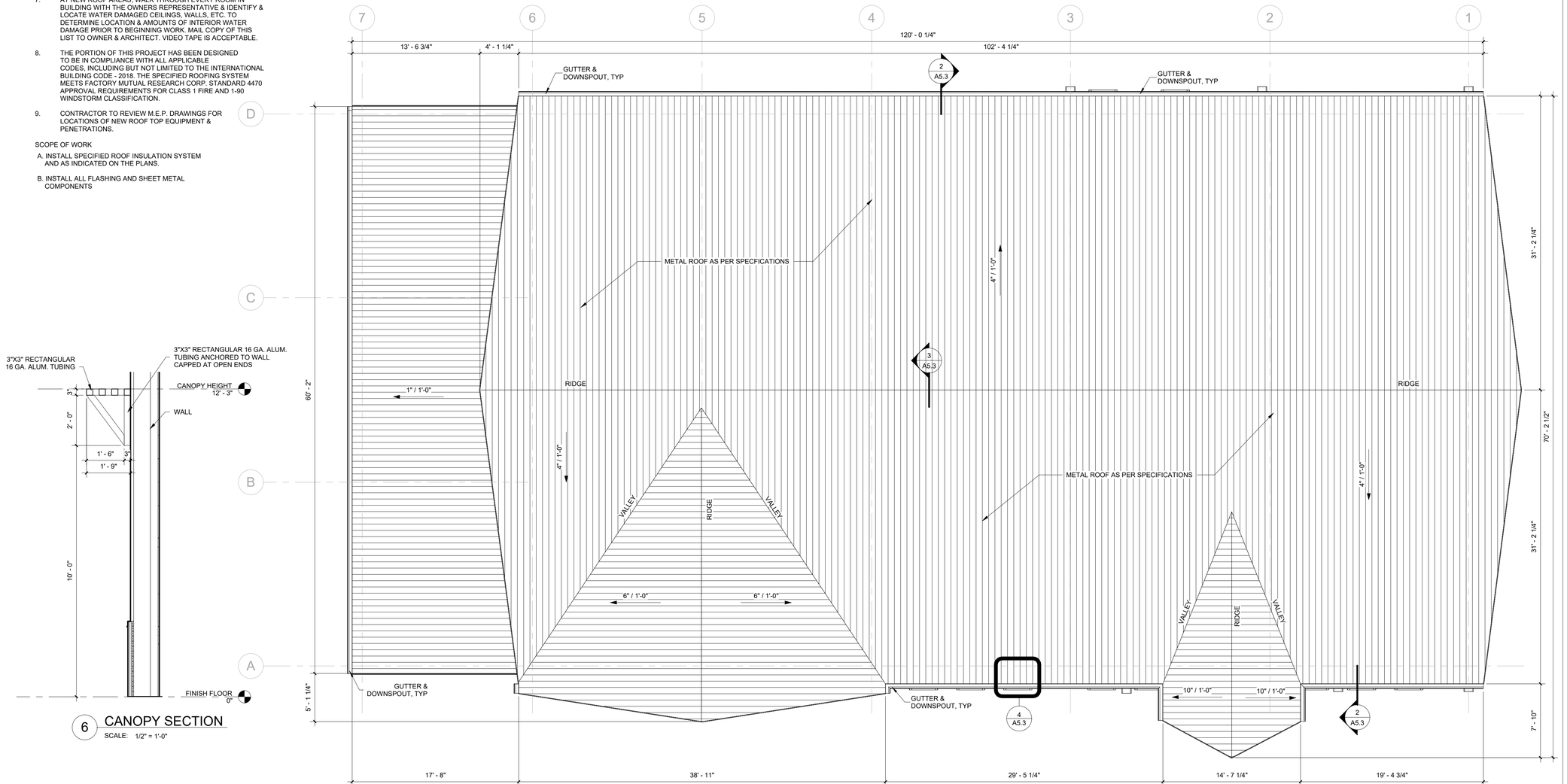
4 CANOPY DETAIL
SCALE: 1/2" = 1'-0"



3 RIDGE VENT DETAIL
SCALE: 1 1/2" = 1'-0"



2 EAVE DETAIL
SCALE: 1 1/2" = 1'-0"



1 ROOF PLAN
SCALE: 3/16" = 1'-0"

6 CANOPY SECTION
SCALE: 1/2" = 1'-0"

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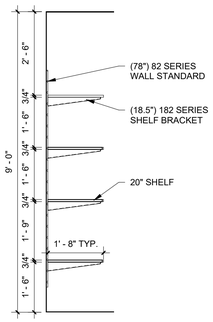
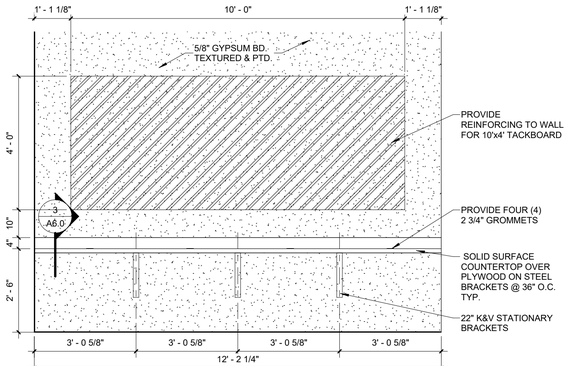
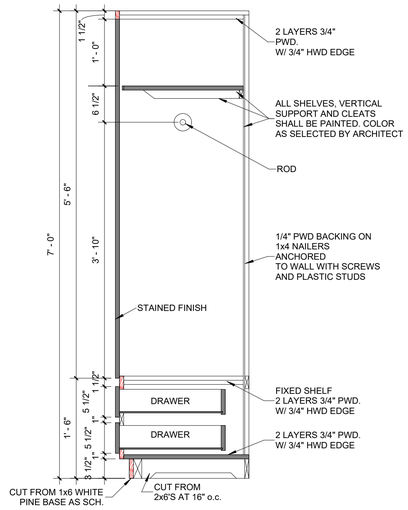
SHEET NUMBER
A5.3



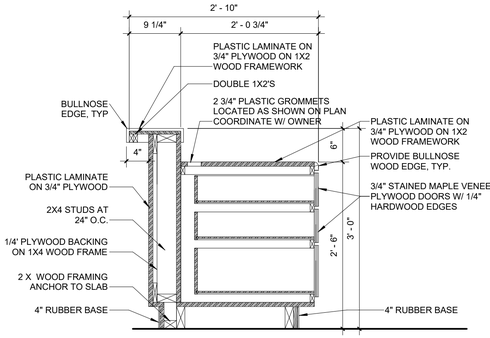
10 PANTRY SECTION
SCALE: 1/2" = 1'-0"



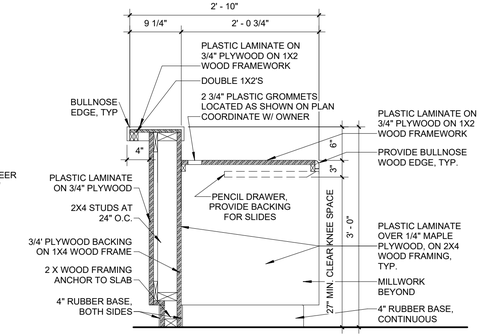
9 WORKSTATION ELEVATION
SCALE: 1/2" = 1'-0"



8 MILLWORK SECTION
SCALE: 1" = 1'-0"



5 RECEPTION MILLWORK
SCALE: 1" = 1'-0"



4 RECEPTION MILLWORK
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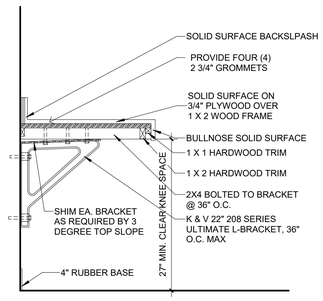
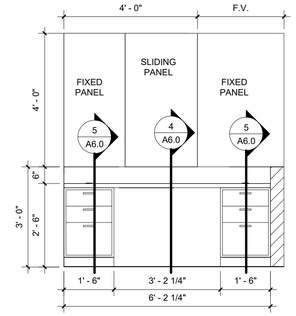
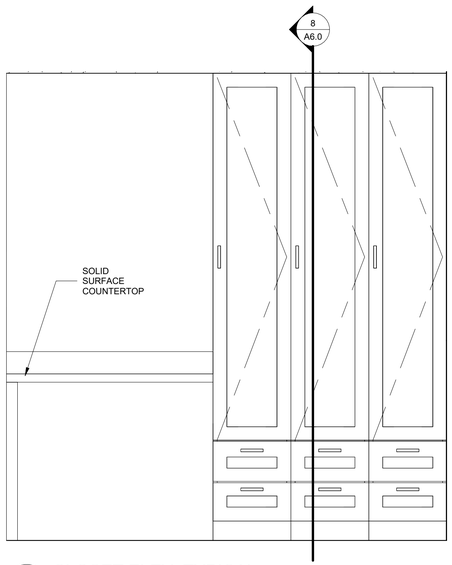


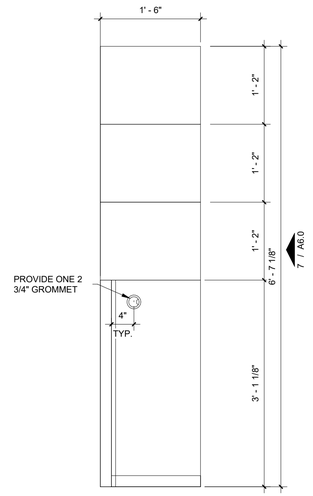
3 WORKSTATION MILLWORK
SCALE: 1" = 1'-0"



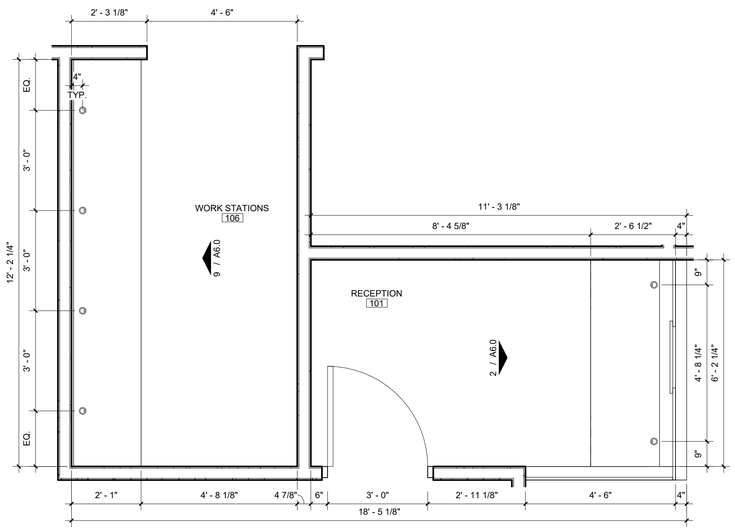
2 RECEPTION MILLWORK ELEV.
SCALE: 1/2" = 1'-0"



7 CLOSET ELEV. TYPICAL
SCALE: 1" = 1'-0"



6 DORM MILLWORK
SCALE: 1" = 1'-0"



1 WORKSTATION/RECEPTION ENLARGED PLAN
SCALE: 1/2" = 1'-0"

MILNET
ARCHITECTURAL
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10/15/2024

HIDALGO COUNTY REMOTE
OPERATIONS CENTER PRECINCT 1
THE COUNTY OF HIDALGO
708 E. EDINGBURG AVE.
ELSA, TX 78543

PROJECT NUMBER
224003

DATE
10/15/2024

CONSTRUCTION SET

SHEET NUMBER
A6.0

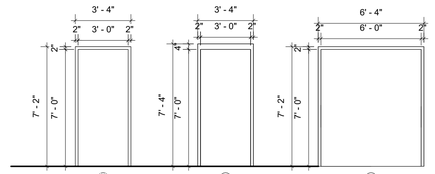
DOOR SCHEDULE

MARK	DESCRIPTION	TYPE	WIDTH	HEIGHT	THICK.	MATERIAL	FINISH	FRAME TYPE	DOOR HARDWARE	HEAD DETAIL	JAMB DETAIL	SILL DETAIL	COMMENTS
100	LOBBY	A	3' - 0"	7' - 0"	1 3/4"	ALUMINUM & GLASS	ANODIZED	ALUMINUM	REF: SPECS	-	-	-	REFER NOTE 2,REF. AS PER MANUFACTURER
100A	LOBBY	B	3' - 0"	7' - 0"	1 3/4"	SOLID CORE WOOD	STAINED	A	REF: SPECS	1/A7.0	2/A7.0	3/A7.0	ACCESS CONTROL/REFER NOTE 2
101	RECEPTION	B	3' - 0"	7' - 0"	1 3/4"	SOLID CORE WOOD	STAINED	A	REF: SPECS	1/A7.0	2/A7.0	3/A7.0	
102	CONFERENCE ROOM	F	3' - 0"	7' - 0"	1 3/4"	ALUMINUM & GLASS	ANODIZED	ALUMINUM	REF: SPECS	-	-	-	REF. AS PER MANUFACTURER
103	MEETING ROOM	F	3' - 0"	7' - 0"	1 3/4"	ALUMINUM & GLASS	ANODIZED	ALUMINUM	REF: SPECS	-	-	-	REF. AS PER MANUFACTURER
104	OFFICE	F	3' - 0"	7' - 0"	1 3/4"	ALUMINUM & GLASS	ANODIZED	ALUMINUM	REF: SPECS	-	-	-	REF. AS PER MANUFACTURER
105	OFFICE	F	3' - 0"	7' - 0"	1 3/4"	ALUMINUM & GLASS	ANODIZED	ALUMINUM	REF: SPECS	-	-	-	REF. AS PER MANUFACTURER
107	STORAGE	C	3' - 0"	7' - 0"	1 3/4"	SOLID CORE WOOD	STAINED	A	REF: SPECS	1/A7.0	2/A7.0	3/A7.0	
108	HALLWAY	B	3' - 0"	7' - 0"	1 3/4"	SOLID CORE WOOD	STAINED	A	REF: SPECS	1/A7.0	2/A7.0	3/A7.0	ACCESS CONTROL/REFER NOTE 2
109	MULTI PURPOSE/ TRAINING ROOM	F	3' - 0"	7' - 0"	1 3/4"	ALUMINUM & GLASS	ANODIZED	ALUMINUM	REF: SPECS	-	-	-	REF. AS PER MANUFACTURER
109A	MULTI PURPOSE/ TRAINING ROOM	A	3' - 0"	7' - 0"	1 3/4"	ALUMINUM & GLASS	ANODIZED	ALUMINUM	REF: SPECS	-	-	-	REF. AS PER MANUFACTURER
109B	MULTI PURPOSE/ TRAINING ROOM	D	3' - 0"	7' - 0"	1 3/4"	SOLID CORE WOOD	STAINED	A	REF: SPECS	1/A7.0	2/A7.0	3/A7.0	
110	ELECTRICAL ROOM	D	3' - 0"	7' - 0"	1 3/4"	HOLLOW METAL	PAINTED	A	REF: SPECS	1/A7.0	2/A7.0	3/A7.0	
111	MEN'S RESTROOM	C	3' - 0"	7' - 0"	1 3/4"	SOLID CORE WOOD	STAINED	A	REF: SPECS	1/A7.0	2/A7.0	3/A7.0	
112	WOMEN'S RESTROOM	C	3' - 0"	7' - 0"	1 3/4"	SOLID CORE WOOD	STAINED	A	REF: SPECS	1/A7.0	2/A7.0	3/A7.0	
113	HALLWAY	C	3' - 0"	7' - 0"	1 3/4"	SOLID CORE WOOD	STAINED	A	REF: SPECS	1/A7.0	2/A7.0	3/A7.0	REFER NOTE 2
113A	HALLWAY	D	3' - 0"	7' - 0"	1 3/4"	HOLLOW METAL	PAINTED	B	REF: SPECS	4/A7.0	5/A7.0	6/A7.0	ACCESS CONTROL/REFER NOTE 2
113B	HALLWAY	D	3' - 0"	7' - 0"	1 3/4"	HOLLOW METAL	PAINTED	A	REF: SPECS	10/A7.0	11/A7.0	12/A7.0	ACCESS CONTROL/REFER NOTE 2
115	PANTRY	C	3' - 0"	7' - 0"	1 3/4"	SOLID CORE WOOD	STAINED	A	REF: SPECS	1/A7.0	2/A7.0	3/A7.0	
116	COMMERCIAL KITCHEN	C	3' - 0"	7' - 0"	1 3/4"	SOLID CORE WOOD	STAINED	A	REF: SPECS	1/A7.0	2/A7.0	3/A7.0	
117	DORM	B	3' - 0"	7' - 0"	1 3/4"	SOLID CORE WOOD	STAINED	A	REF: SPECS	1/A7.0	2/A7.0	3/A7.0	
118	DORM RESTROOMS	C	3' - 0"	7' - 0"	1 3/4"	SOLID CORE WOOD	STAINED	A	REF: SPECS	1/A7.0	2/A7.0	3/A7.0	
119	RISER	D	3' - 0"	7' - 0"	1 3/4"	HOLLOW METAL	PAINTED	A	REF: SPECS	7/A7.0	8/A7.0	9/A7.0	
120	MDF	D	3' - 0"	7' - 0"	1 3/4"	HOLLOW METAL	PAINTED	A	REF: SPECS	1/A7.0	2/A7.0	3/A7.0	ACCESS CONTROL
121	MECHANICAL ROOM	E	6' - 0"	7' - 0"	1 3/4"	HOLLOW METAL	PAINTED	C	REF: SPECS	7/A7.0	8/A7.0	9/A7.0	ACCESS CONTROL
122	BAY	D	3' - 0"	7' - 0"	1 3/4"	HOLLOW METAL	PAINTED	A	REF: SPECS	13/A7.0	14/A7.0	15/A7.0	
122A	BAY	H	14' - 0"	14' - 0"	2"	GALVANIZED STEEL	POWDER COATED	AS PER MANUF.	REF: SPECS	-	-	-	REFER NOTE 1
122B	BAY	H	14' - 0"	14' - 0"	2"	GALVANIZED STEEL	POWDER COATED	AS PER MANUF.	REF: SPECS	-	-	-	REFER NOTE 1
122C	BAY	G	8' - 0"	10' - 0"	2"	GALVANIZED STEEL	POWDER COATED	AS PER MANUF.	REF: SPECS	-	-	-	REFER NOTE 1
122D	BAY	H	14' - 0"	14' - 0"	2"	GALVANIZED STEEL	POWDER COATED	AS PER MANUF.	REF: SPECS	-	-	-	REFER NOTE 1
122E	BAY	H	14' - 0"	14' - 0"	2"	GALVANIZED STEEL	POWDER COATED	AS PER MANUF.	REF: SPECS	-	-	-	REFER NOTE 1

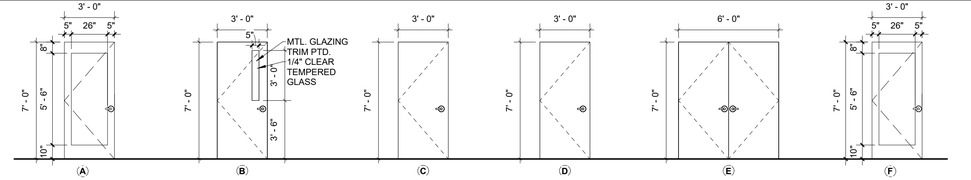
NOTES

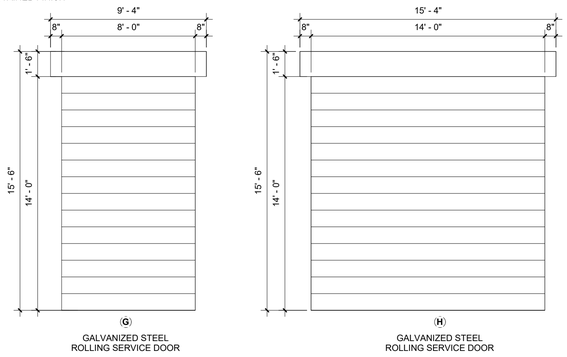
1. PROVIDE AND INSTALL ROLLING STEEL DOOR MODEL 610 (STANDARD C-187 SLAT PROFILE, 22 GA.) WITH RHX ELECTRIC OPERATOR, FACE TO WALL MOUNTED, FROM OVERHEAD DOOR OR APPROVED EQUAL
2. PROVIDE MAGNETIC RELEASE OPERATED BY RECEPTIONST AND CARD READER TO OPEN

FRAME TYPES

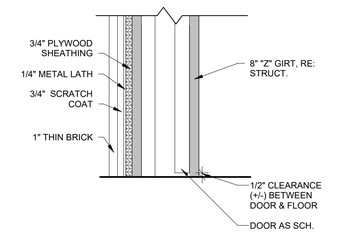


DOOR TYPES

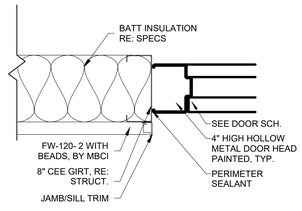




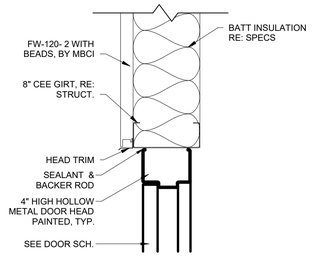
DOOR DETAILS



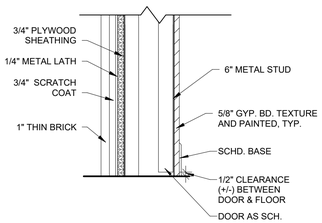
15 EXT. DOOR SILL DETAIL
SCALE: 1 1/2" = 1'-0"



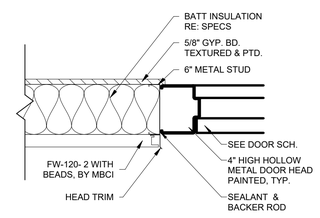
14 EXT. DOOR JAMB DETAIL
SCALE: 1 1/2" = 1'-0"



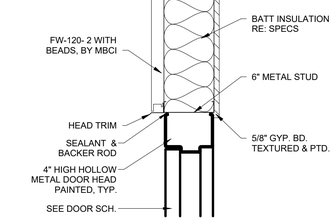
13 EXT. DOOR HEAD DETAIL
SCALE: 1 1/2" = 1'-0"



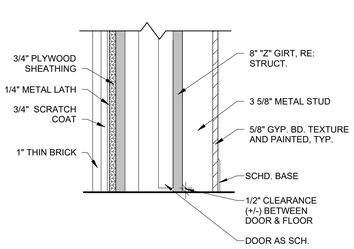
12 EXT. DOOR SILL DETAIL
SCALE: 1 1/2" = 1'-0"



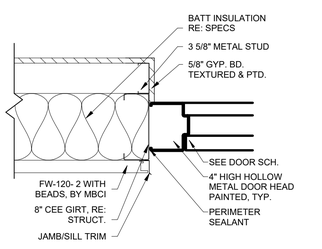
11 EXT. DOOR JAMB DETAIL
SCALE: 1 1/2" = 1'-0"



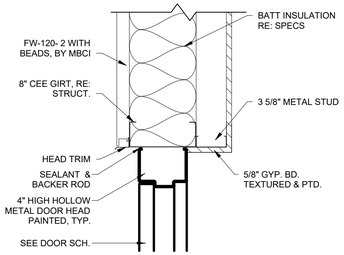
10 EXT. DOOR HEAD DETAIL
SCALE: 1 1/2" = 1'-0"



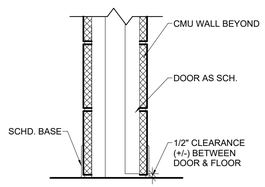
9 EXT. DOOR SILL DETAIL
SCALE: 1 1/2" = 1'-0"



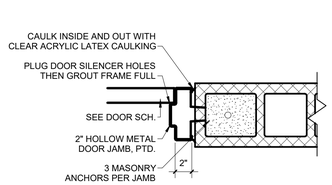
8 EXT. DOOR JAMB DETAIL
SCALE: 1 1/2" = 1'-0"



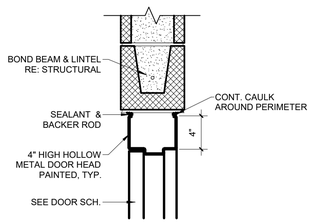
7 EXT. DOOR HEAD DETAIL
SCALE: 1 1/2" = 1'-0"



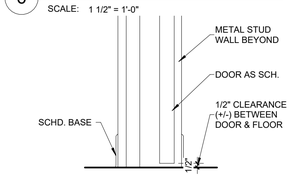
6 DOOR SILL DETAIL AT CMU
SCALE: 1 1/2" = 1'-0"



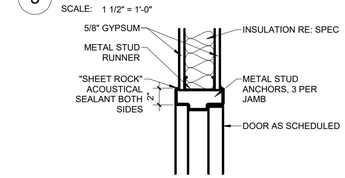
5 DOOR JAMB DETAIL AT CMU
SCALE: 1 1/2" = 1'-0"



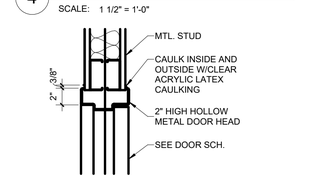
4 DOOR HEAD DETAIL AT CMU
SCALE: 1 1/2" = 1'-0"



3 INT DOOR SILL DETAIL
SCALE: 1 1/2" = 1'-0"



2 INT. DOOR JAMB DETAIL
SCALE: 1 1/2" = 1'-0"



1 INT. DOOR HEAD DETAIL
SCALE: 1 1/2" = 1'-0"

MILNET ARCHITECTURAL SERVICES
AMERICAN INSTITUTE OF ARCHITECTS

10/15/2024

HIDALGO COUNTY REMOTE OPERATIONS CENTER PRECINCT 1
THE COUNTY OF HIDALGO
708 E. EDINGBURG AVE.
ELSA, TX 78543

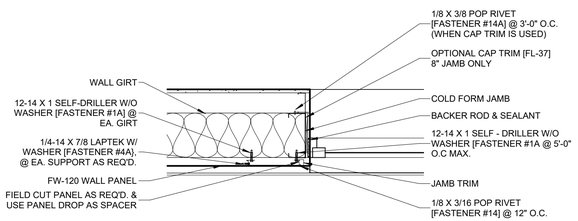
PROJECT NUMBER
224003

DATE
10/15/2024

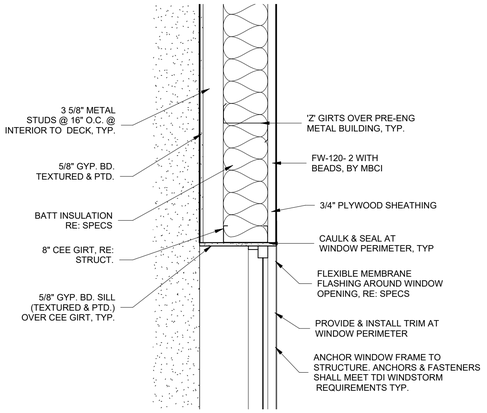
CONSTRUCTION SET

SHEET NUMBER
A7.0

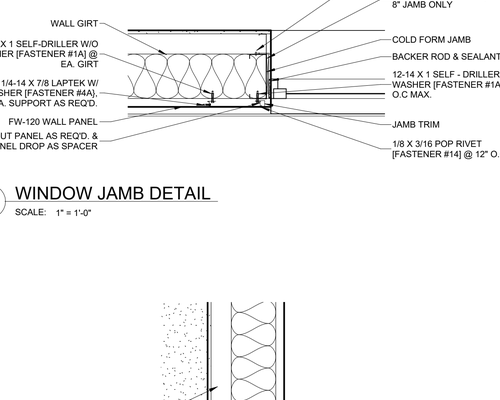
WINDOW DETAILS



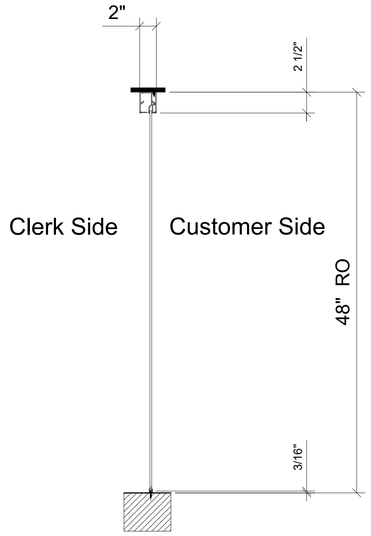
11 WINDOW JAMB DETAIL
SCALE: 1" = 1'-0"



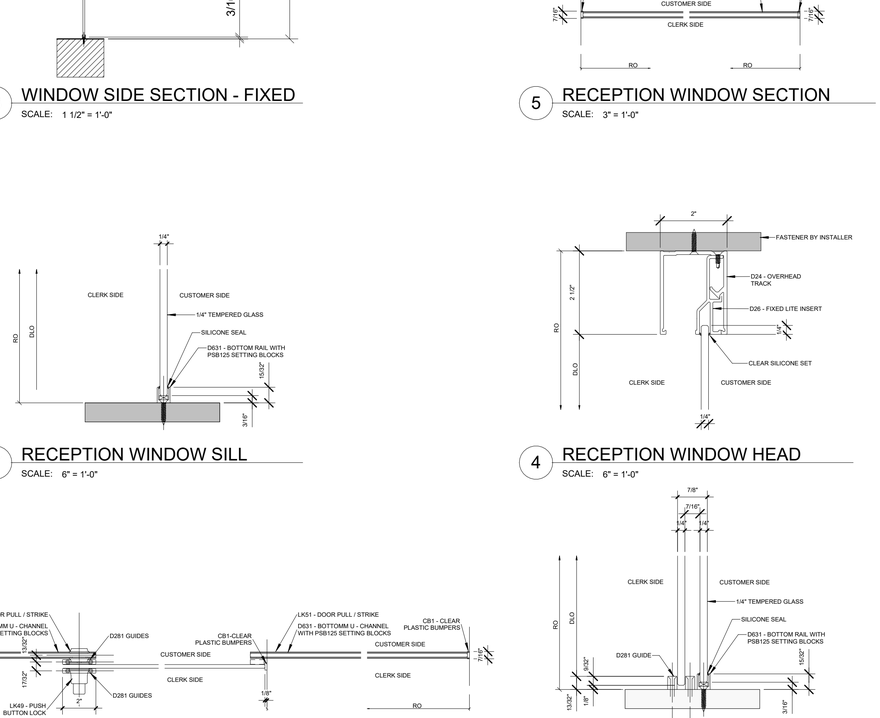
10 WINDOW HEAD DETAIL
SCALE: 1" = 1'-0"



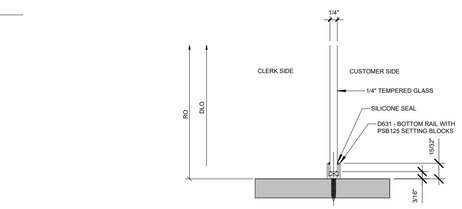
9 WINDOW SILL DETAIL
SCALE: 1" = 1'-0"



8 WINDOW SIDE SECTION - FIXED
SCALE: 1 1/2" = 1'-0"

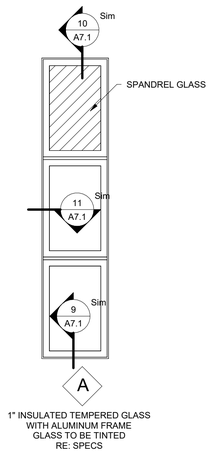


6 RECEPTION WINDOW-SECTION
SCALE: 3" = 1'-0"

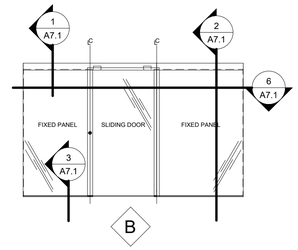


7 RECEPTION WINDOW SILL
SCALE: 6" = 1'-0"

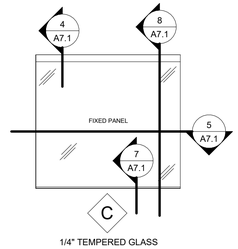
WINDOW TYPES



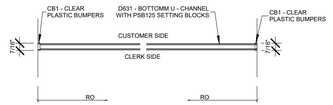
1" INSULATED TEMPERED GLASS
WITH ALUMINUM FRAME
GLASS TO BE TINTED
RE: SPECS



1/4" TEMPERED GLASS



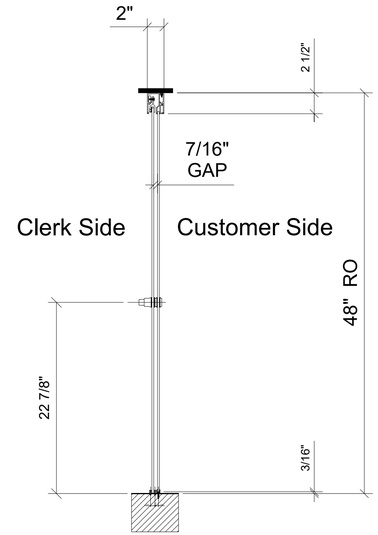
1/4" TEMPERED GLASS



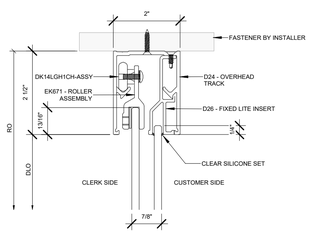
5 RECEPTION WINDOW SECTION
SCALE: 3" = 1'-0"

4 RECEPTION WINDOW HEAD
SCALE: 6" = 1'-0"

3 RECEPTION WINDOW- SILL
SCALE: 6" = 1'-0"



2 WINDOW SIDE SECTION
SCALE: 1 1/2" = 1'-0"



1 RECEPTION WINDOW- HEAD
SCALE: 6" = 1'-0"

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10/15/2024

HIDALGO COUNTY REMOTE OPERATIONS CENTER PRECINCT 1
THE COUNTY OF HIDALGO
708 E. EDINGBURG AVE.
ELSA, TX 78543

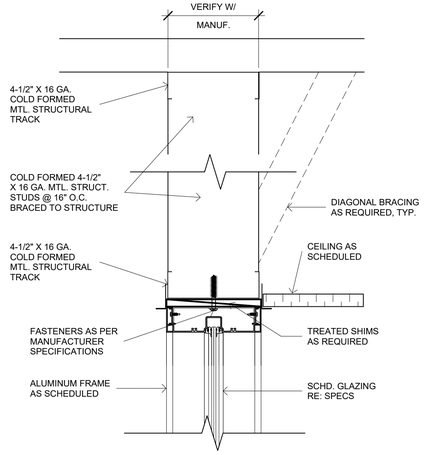
PROJECT NUMBER
224003

DATE
10/15/2024

CONSTRUCTION SET

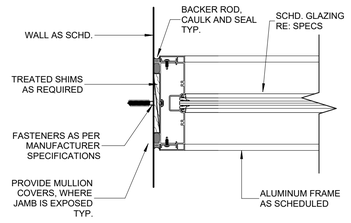
SHEET NUMBER
A7.1

STOREFRONT DETAILS



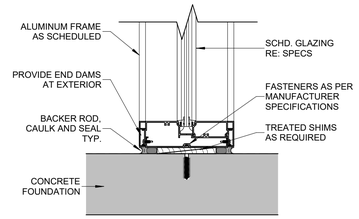
1 STOREFRONT HEAD DETAIL

SCALE: 3" = 1'-0"



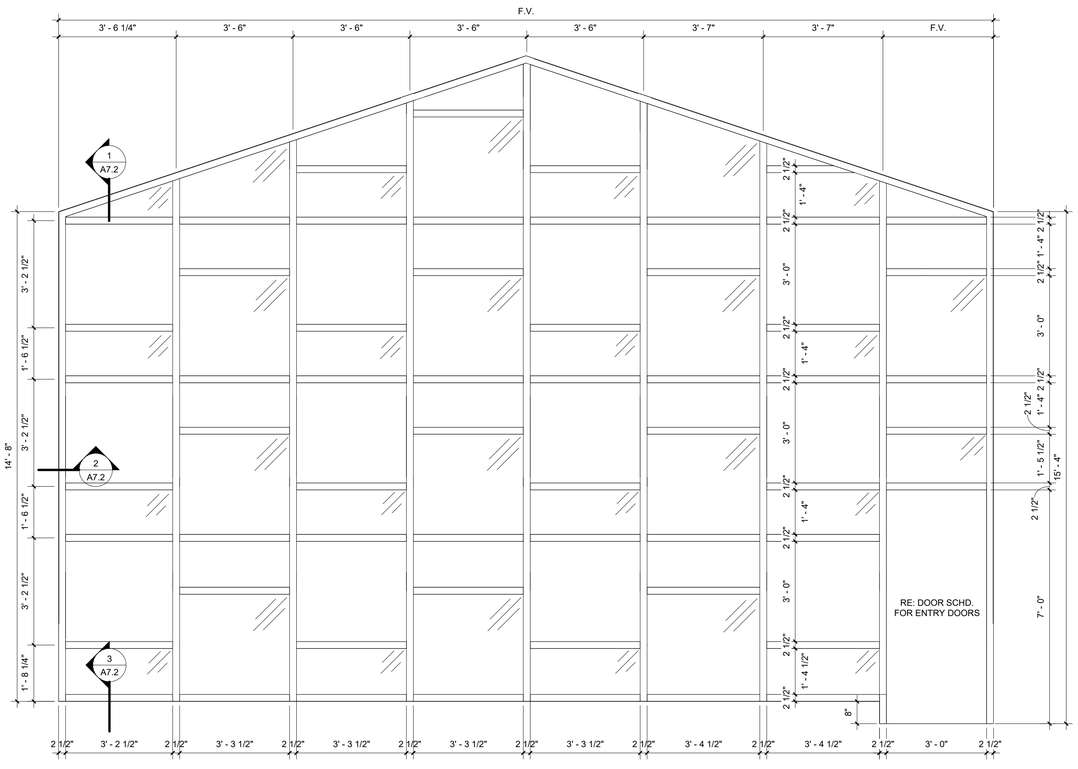
2 STOREFRONT JAMB DETAIL

SCALE: 3" = 1'-0"



3 STOREFRONT SILL DETAIL

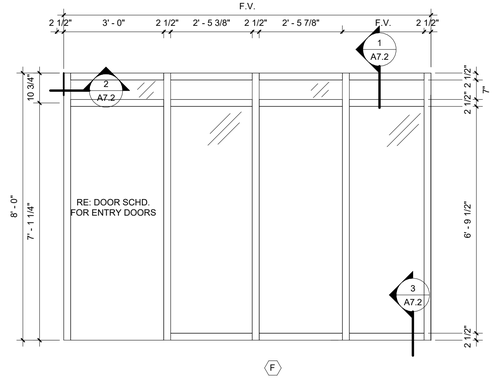
SCALE: 3" = 1'-0"



G

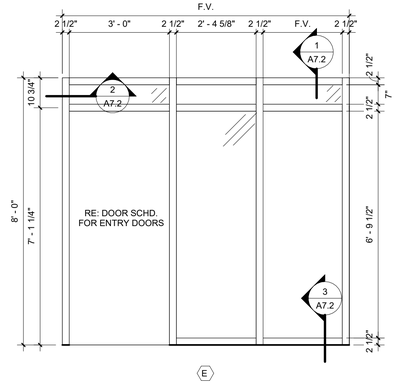
1" INSULATED TEMPERED GLASS
WITH ALUMINUM FRAME
GLASS TO BE TINTED
RE: SPECS

STOREFRONT TYPES



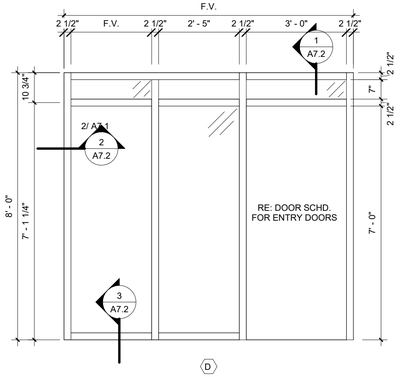
F

1/4" TEMPERED GLASS
WITH ALUMINUM FRAME
GLASS TO BE CLR.
RE: SPECS



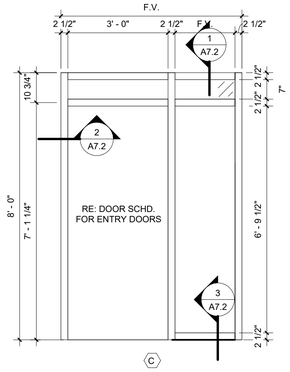
E

1/4" TEMPERED GLASS
WITH ALUMINUM FRAME
GLASS TO BE CLR.
RE: SPECS



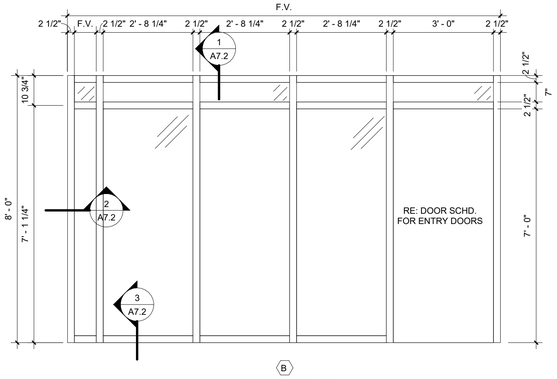
D

1/4" TEMPERED GLASS
WITH ALUMINUM FRAME
GLASS TO BE CLR.
RE: SPECS



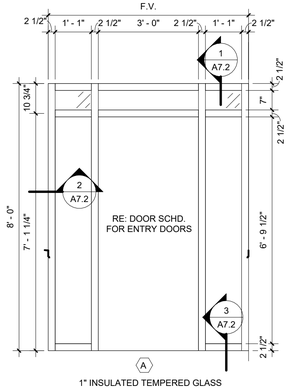
C

1/4" TEMPERED GLASS
WITH ALUMINUM FRAME
GLASS TO BE CLR.
RE: SPECS



B

1/4" TEMPERED GLASS
WITH ALUMINUM FRAME
GLASS TO BE CLR
RE: SPECS



A

1" INSULATED TEMPERED GLASS
WITH ALUMINUM FRAME
GLASS TO BE TINTED
RE: SPECS

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AMERICAN INSTITUTE OF ARCHITECTS

10/15/2024

HIDALGO COUNTY REMOTE
OPERATIONS CENTER PRECINCT 1
THE COUNTY OF HIDALGO
708 E. EDINGBURG AVE.
ELSA, TX 78543

PROJECT NUMBER
224003

DATE
10/15/2024

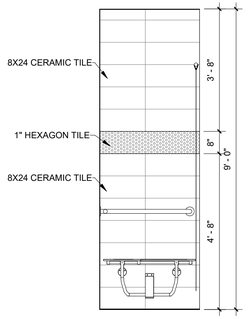
CONSTRUCTION SET

SHEET NUMBER
A7.2

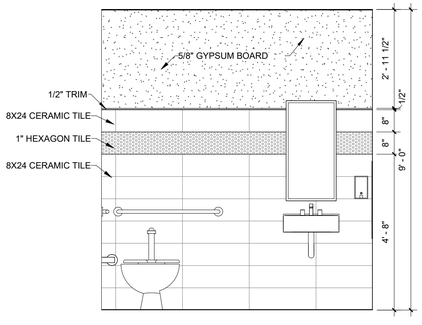
ROOM SCHEDULE							
Number	Name	FINISH KEY NOTE	WALLS	BASE	FLOOR	CEILING	Comments
100	LOBBY	F3	P-1	B-1	LVT	C-2	
101	RECEPTION	F1	P-1	B-1	LVT	C-1	
102	CONFERENCE ROOM	F4	P-1	B-1	CPT	C-1	
103	MEETING ROOM	F4	P-1	B-1	CPT	C-1	
104	OFFICE	F4	P-1	B-1	CPT	C-1	
105	OFFICE	F4	P-1	B-1	CPT	C-1	
106	WORK STATIONS	F1	P-1	B-1	LVT	C-1	
107	STORAGE	F1	P-1	B-1	LVT	C-1	
108	HALLWAY	F1	P-1	B-1	LVT	C-1	
109	MULTI PURPOSE/ TRAINING ROOM	F3	P-1	B-1	LVT	C-2	
110	ELECTRICAL ROOM	F6	P-1	B-1	SC	C-3	
111	MEN'S RR	F2	P-2	B-2	CT	C-2	
112	WOMEN'S RR	F2	P-2	B-2	CT	C-2	
113	HALLWAY	F1	P-1	B-1	LVT	C-1	
114	UTILITY	F5	PVC	AS30	AS30	C-2	
115	PANTRY	F5	PVC	AS30	AS30	C-2	
116	COMMERCIAL KITCHEN	F5	PVC	AS30	AS30	C-2	
117	DORM	F1	P-1	B-1	LVT	C-1	
118	BATHROOM	F2	P-2	B-2	CT	C-2	
119	RISER	F6	P-1	B-1	SC	C-3	
120	MDF	F3	P-1	B-1	LVT	C-2	
121	MECHANICAL ROOM	F6	P-1	B-1	SC	C-3	
122	BAYS	F6	P-1	B-1	SC	C-3	

ROOM FINISH STANDARDS	
WALLS	
P-1	LATEX PAINT
P-2	EPOXY PAINT
PVC	ALTRO PURAGUARD PVC SURFACE
FLOOR COVERINGS	
CPT	CARPET
CT	CERAMIC TILE
LVT	LUXURY VINYL TILE
SC	SEALED CONCRETE
AS30	ALTRO STRONGHOLD 30
BASE	
B-1	4" METAL WALL BASE
B-2	CERAMIC TILE
AS30	ALTRO STRONGHOLD 30
CEILING	
C-1	SUSP. ACOUSTICAL CEILING (2X2)
C-2	PAINTED GYPSUM BOARD
C-3	EXPOSED STRUCTURE, PAINTED

ROOM FINISH SCHEDULE						
Key Name	WALLS	BASE	FLOOR	CEILING	MISC.	REMARKS
F1	P-1	B-1	LVT	C-1		
F2	P-2	B-2	CT	C-2		CERAMIC WALL TILE WAINSCOT. REFER TO DETAIL 2/A7.0
F3	P-1	B-1	LVT	C-2		
F4	P-1	B-1	CPT	C-1		
F5	PVC	AS30	AS30	C-2		
F6	P-1	B-1	SC	C-3		



3 TYP. SHOWER WALL ELEV.
SCALE: 1/2" = 1'-0"



2 TYP. RESTROOM WALL ELEV.
SCALE: 1/2" = 1'-0"

1 FINISH FLOOR PLAN
SCALE: 3/16" = 1'-0"

MILNET ARCHITECTURAL SERVICES
AMERICAN INSTITUTE OF ARCHITECTS

REGISTERED ARCHITECT 74740 STATE OF TEXAS

10/15/2024

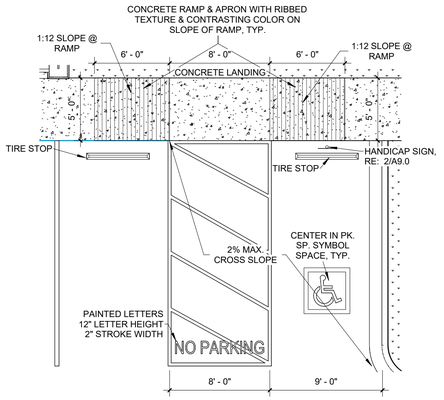
HIDALGO COUNTY REMOTE OPERATIONS CENTER PRECINCT 1
THE COUNTY OF HIDALGO
708 E. EDINGBURG AVE.
ELSA, TX 78543

PROJECT NUMBER
224003

DATE
10/15/2024

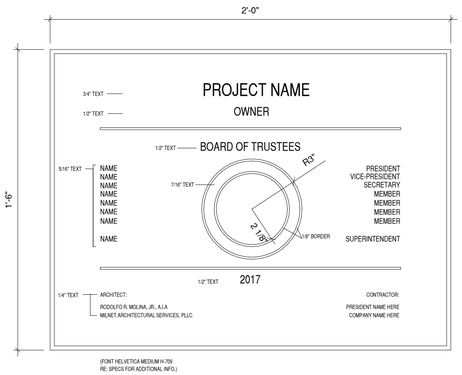
CONSTRUCTION SET

SHEET NUMBER
A7.3



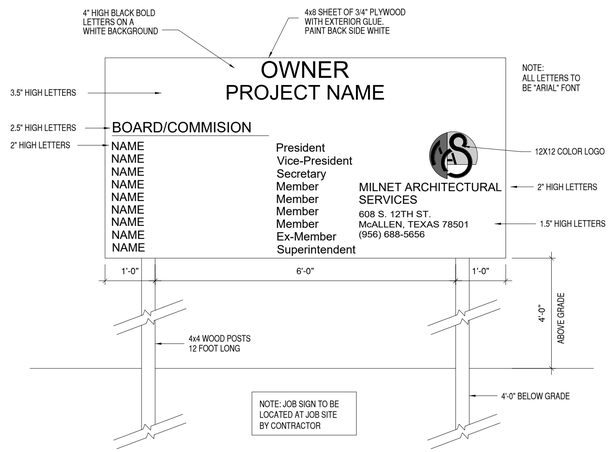
6 ADA PARKING SPACE

SCALE: 3/16" = 1'-0"



5 PLAQUE

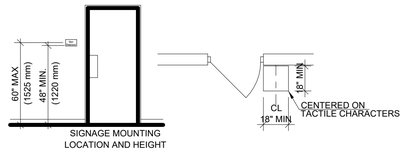
SCALE: N.T.S.



4 JOB SITE SIGN

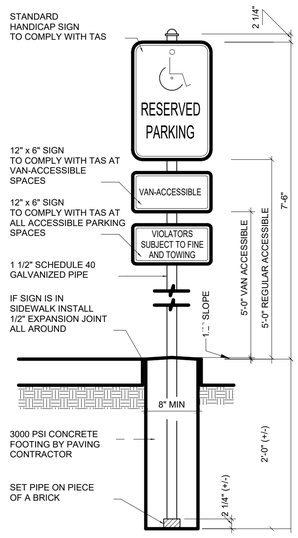
SCALE: N.T.S.

1. COLOR AS CLOSE TO COUNTERTOP AS POSSIBLE BASED ON STANDARD COLORS.
2. SIGNS THAT DESIGNATE PERMANENT ROOMS AND SPACES MUST COMPLY WITH REQUIREMENTS FOR CHARACTER PROPORTION, RAISED AND BRAILLED CHARACTERS AND PICTORIAL SYMBOLS SIGNS, FINISH AND CONTRAST, AND MOUNTING AND LOCATION HEIGHT.
3. CHARACTER PROPORTION: CHARACTERS SHALL BE SELECTED FROM FONTS WHERE THE WIDTH OF THE UPPERCASE LETTER "O" IS 55 PERCENT MINIMUM AND 110 PERCENT MAXIMUM OF THE HEIGHT OF THE UPPERCASE LETTER "I".
4. RAISED AND BRAILLED CHARACTERS AND PICTORIAL SYMBOL SIGNS (PICTOGRAMS): LETTERS AND NUMERALS SHALLS BE RAISED 1/32 IN, UPPER-CASE, SANS SERIF AND SHALL BE ACCOMPANIED WITH GRADE 2 BRAILLE. RAISED CHARACTERS SHALL BE AT LEAST 5/8 IN. (16mm) HIGH, BUT NO HIGHER THAN 2 IN. (50mm). PICTOGRAMS SHALL BE ACCOMPANIED BY THE EQUIVALENT VERBAL DESCRIPTION PLACED DIRECTLY BELOW THE PICTOGRAM. THE BORDER DIMENSION OF THE PICTOGRAM SHALL BE 6 IN. (152mm) MINIMUM IN HEIGTH.
5. FINISH AND CONTRAST: CHARACTERS AND THEIR BACKGROUND SHALL HAVE A NON-GLARE FINISH. CHARACTERS SHALL CONTRAST WITH THEIR BACKGROUND WITH EITHER LIGHT CHARACTERS ON A DARK BACKGROUND OR DARK CHARACTERS ON A LIGHT BACKGROUND.
6. MOUNTING LOCATION AND HEIGHT. WHERE PERMANENT IDENTIFICATION IS PROVIDED FOR ROOMS AND SPACES, SIGNS SHALL BE INSTALLED ALONGSIDE DOOR AT THE LATCH SIDE. WHERE A TACTILE SIGN IS PROVIDED AT DOUBLE DOORS WITH ONE ACTIVE LEAF, THE SIGN SHALL BE INSTALLED ON THE INACTIVE LEAF. WHERE A TACTILE SIGN IS PROVIDED AT DOUBLE DOORS WITH TWO ACTIVE LEAFS, THE SIGN SHALL BE INSTALLED TO THE RIGHT OF THE RIGHT HAND DOOR. WHERE THERE IS NO WALL SPACE AT THE LATCH SIDE OF A SINGLE DOOR OR AT THE RIGHT SIDE OF DOUBLE DOORS, SIGND SHALL BE LOCATED ON THE NEAREST ADJACENT WALL. SIGNS CONTAINING TACTILE CHARACTERS SHALL BE LOCATED SO THAT A CLEAR FLOOR SPACE OF 18" MIN. BY 18" MIN., CENTERED ON THE TACTILE CHARACTERS, IS PROVIDED BEYOND THE ARC OF ANY DOOR SWING BETWEEN THE CLOSED POSITION AND 45 DEGREE OPEN POSITION.



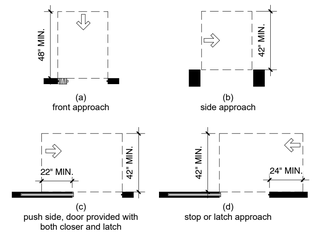
3 ADA - INTERIOR SIGNAGE SPECS

SCALE: N.T.S.



2 ADA - PARKING SIGNAGE

SCALE: N.T.S.

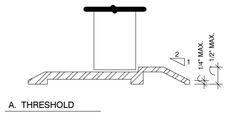


MANEUVERING CLEARANCE AT DOORWAYS WITHOUT DOORS, SLIDING DOORS, GATES AND FOLDING DOORS

DOOR CRITERIA:

GENERAL NOTES:

1. FLOOR OR GROUND SURFACE. FLOOR OR GROUND SURFACE WITHIN REQUIRED MANEUVERING CLEARANCE SHALL BE STABLE FIRM, AND SLIP RESISTANT. CHANGES IN LEVEL ARE NOT PERMITTED.
2. VISION LIGHTS. DOORS, GATES, AND SIDE LIGHTS ADJACENT TO DOOR OR GATES, SHALL HAVE THE BOTTOM OF AT LEAST ONE GLAZED PANEL LOCATED 43" MAX. ABOVE THE FINISH FLOOR



A. THRESHOLD

NOTES:

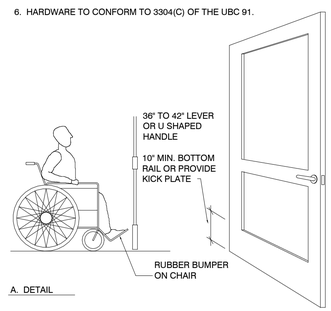
1. 1/2" MAXIMUM TOTAL HEIGHT WITH 1/4" MAXIMUM VERTICAL CHANGE AT EDGE.
2. 1 : 2 SLOPED BEVEL REQUIRED IF LEVEL CHANGE IS OVER 1/4" VERTICAL CHANGE.

DOOR TYPE:

1. MINIMUM 10" HIGH SMOOTH SURFACE AT DOOR BOTTOM, EITHER ATTACHED PANEL OR BOTTOM RAIL.

HARDWARE:

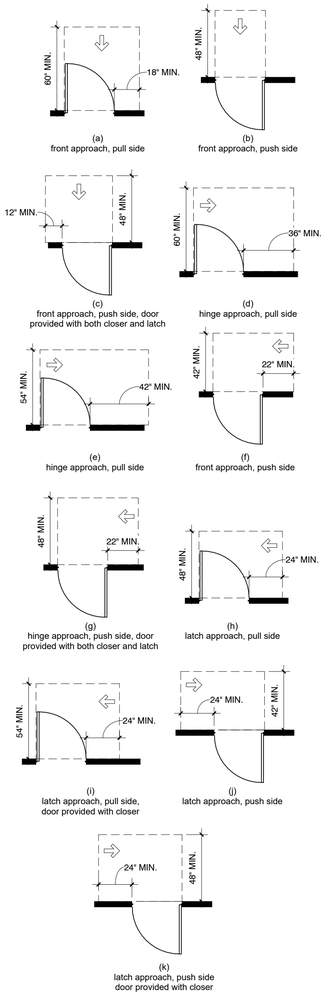
2. OPERABLE FROM INSIDE WITHOUT USE OF KEY OR SPECIAL KNOWLEDGE OR EFFORT.
3. OPENABLE BY SINGLE EFFORT LEVER-TYPE DEVICE (NOT REQUIRING GRASPING).
4. MOUNTED 36" TO 42".
5. MAXIMUN 8.5 POUNDS EFFORT TO OPERATE EXTERIOR DOOR, 5 POUNDS FOR INTERIOR
6. HARDWARE TO CONFORM TO 3304(C) OF THE UBC 91.



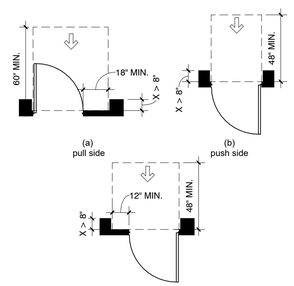
A. DETAIL

1 DOOR CRITERIA

SCALE: N.T.S.



MANEUVERING CLEARANCE AT MANUAL SWINGING DOORS AND GATES



MANEUVERING CLEARANCE AT RECESSED DOORS AND GATES

MILNET
ARCHITECTURAL
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AMERICAN INSTITUTE OF ARCHITECTS

REGISTERED ARCHITECT RODOLFO R. MOLINA JR. 74740 STATE OF TEXAS

10/15/2024

HIDALGO COUNTY REMOTE OPERATIONS CENTER PRECINCT 1
THE COUNTY OF HIDALGO
708 E. EDINGBURG AVE.
ELSA, TX 78543

PROJECT NUMBER
224003

DATE
10/15/2024

CONSTRUCTION SET

SHEET NUMBER
A8.0

GENERAL NOTES - MECHANICAL:

(1) THE MECHANICAL CONTRACTOR IS FULLY RESPONSIBLE FOR PERFORMING THE WORK IN FULL COMPLIANCE WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL CODES UNDER THIS SECTION OF THE CONTRACT. IF THE CONTRACTOR DETERMINES THAT THE CONTRACT DOCUMENTS AND PLANS ARE NOT IN COMPLIANCE WITH THE APPLICABLE LOCAL CODES, HE/SHE SHALL INFORM THE ARCHITECT PRIOR TO CONSTRUCTION START FOR DIRECTION. FAILURE TO DO SO SHALL NOT RELIEVE THE CONTRACTOR OF HIS RESPONSIBILITY TO MEET APPLICABLE LOCAL CODES. AND RE-WORK SHALL BE AT CONTRACTOR'S EXPENSE.

(2) CONTRACTOR SHALL HANG AND INSTALL ALL DUCTWORK FLUSH WITH THE BUILDING STRUCTURE TO ACCOMMODATE NEW CEILINGS. CONTRACTOR SHALL COORDINATE ALL INSTALLATION WORK WITH ARCHITECTURAL AND ELECTRICAL DESIGN. ALL DUCTWORK SHALL BE MODIFIED AS NECESSARY AND REQUIRED TO FIT AROUND BUILDING STRUCTURES, ARCHITECTURAL BUILD-OUT AND ELECTRICAL CABLE TRAY INSTALLATIONS. MECHANICAL CONTRACTOR SHALL FAMILIARIZE HIMSELF WITH THE WORK SCOPE OF OTHER TRADES AND PARTICIPATE IN COORDINATING ALL CONSTRUCTION EFFORTS.

(3) CONNECT EACH DIFFUSER TO THE MAIN DISTRIBUTION DUCTS WITH A FLEX-DUCT SECTION; CONNECTIONS SHALL BE COMPLETED IN ACCORDANCE WITH THE DETAIL. EACH FLEX-DUCT CONNECTION SHALL INCLUDE A BUTTERFLY DAMPER TO BE INSTALLED AT THE TRUNK DUCT.

(4) CONTRACTOR SHALL PROVIDE ALL DUCTWORK REQUIRED TO COMPLETE THE HVAC SYSTEM. TIE IN BRANCH DUCTS TO MAIN DUCTS WITH SHEET METAL FLANGES. FLANGE CONNECTION SHALL BE FASTENED WITH CRIMPED SHEET METAL STRIPS AND SEALED WITH SILICONE CAULK.

(5) CONTRACTOR SHALL SUPPLY AND INSTALL FIRE DAMPERS AND ACCESS DOORS IN THE HORIZONTAL DUCTS WHERE THEY PENETRATE FIRE WALLS & BARRIERS.

(6) ALL OPENINGS CUT IN MASONRY AND PLASTER WALLS OR CONCRETE FLOORS SHALL BE CORE DRILLED OR SAWED WHEN POSSIBLE. CONTRACTOR SHALL CHECK BUILDING CONSTRUCTION BEFORE MAKING PENETRATIONS TO AVOID CUTTING THROUGH STRUCTURAL BEAMS AND REINFORCING. CONTRACTOR SHALL INFORM THE ENGINEER IF REINFORCING IS CUT OR DAMAGED WHILE MAKING OPENINGS. CONTRACTOR SHALL REINFORCE ALL OPENINGS AS REQUIRED BY DRAWINGS AND SPECIFICATIONS. PATCH AND SEAL OPENINGS WITH 8000 PSI CEMENT GROUT. INSTALL DECORATIVE TRIM (EQUIPMENT FLANGES, FRAMING OR ESCUTCHEONS) AROUND OPENINGS IN FINISHED AREAS. COORDINATE ALL CUTTING AND PATCHING WITH THE OTHER TRADES

(7) ON ANY WORK SHOWN ON MECHANICAL DRAWINGS REQUIRING DEMOLITION OF EXISTING OR NEW BUILDING STRUCTURES AND FINISHES, IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO COMPLETE THE NECESSARY DEMOLITION. CONTRACTOR SHALL PATCH AND REPAIR ALL DEMOLITION WORK. PATCHING SHALL BE COMPLETED WITH THE SAME MATERIALS AS THE SURROUNDING AREAS, OR WITH ARCHITECT-APPROVED PATCHING MATERIALS. REPAIRS SHALL BE COMPLETED ACCORDING TO ARCHITECTURAL SPECIFICATIONS. ALL REFINISHING SHALL BE APPROVED BY THE ARCHITECT.

(8) CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLETING THE INSTALLATION OF THE AIR DISTRIBUTION SYSTEM SHOWN, DUCTWORK, DUCT ACCESSORIES AND CONTROLS SHOWN AND REQUIRED SHALL BE SUPPLIED AND INSTALLED. ALL INSTALLATION WORK SHALL BE DONE IN ACCORDANCE WITH APPLICABLE CODES, INCLUDING NFPA 90A AND 90B.(NFPA 90A: STANDARD FOR THE INSTALLATION OF AIR-CONDITIONING AND VENTILATING SYSTEMS)[NFPA 90B: STANDARD FOR THE INSTALLATION OF WARM AIR HEATING AND AIR-CONDITIONING SYSTEMS)

(9) CONTRACTOR SHALL BALANCE ALL AIR DISTRIBUTION SYSTEMS TO ACHIEVE THE AIR VOLUME REQUIREMENTS INDICATED. BALANCING SHALL INCLUDE ADJUSTMENT OF ALL MANUAL VOLUME DAMPERS, SHUTTER DAMPERS, ZONE DAMPERS (IF REQUIRED), BUTTERFLY DAMPERS AND INDIVIDUAL DIFFUSER VOLUME DAMPERS (FINAL BALANCING ONLY). CONTRACTOR SHALL SUPPLY THE ENGINEER WITH A COMPLETE BALANCING REPORT WHICH INCLUDES, VOLUME, ROOM REFERENCE AND ZONE VOLUME TOTALS.

(10) MOUNT ALL THERMOSTATS (SENSORS) 48" ABOVE THE FINISHED FLOOR LEVEL. THERMOSTATS SHOWN SHALL BE IN CONTROL OF THE ZONE SYSTEM WHICH IS SUPPLYING AIR TO THE AREA WHERE THE THERMOSTAT IS LOCATED. CONTRACTOR SHALL SUPPLY AND INSTALL ALL CONTROL VOLTAGE WIRING AND CONDUIT FOR THERMOSTAT (DDC CONTROL) INSTALLATION.

(11) CONTRACTOR SHALL INSTALL NEW REFRIGERANT PIPING FLUSH WITH THE BUILDING STRUCTURE AND MECHANICAL ROOM BOUNDARIES AS SHOWN. CONTRACTOR SHALL COORDINATE ALL INSTALLATION WORK WITH DUCTS AND ELECTRICAL CONDUIT. MECHANICAL CONTRACTOR SHALL FAMILIARIZE HIMSELF WITH THE WORK SCOPE OF OTHER TRADES AND PARTICIPATE IN COORDINATING ALL CONSTRUCTION EFFORTS.

(12) ALL PIPING SHALL BE INSULATED AND JACKETED. REFER TO THE SPECIFICATIONS. THE CONDENSING AND ROOF TOP CONDENSER COILS ARE TO BE COATED IN ACCORDANCE WITH THE SPECIFICATIONS.

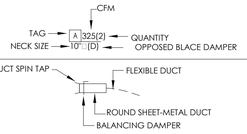
(13) PROVIDE EACH HVAC SYSTEM OF 2000 CFM & GREATER W/ DUCT SMOKE DETECTOR(S) IN COMPLIANCE WITH IBC 907.2.13.1.2 & 907.3.1 IN RETURN AIR DUCTWORK TO SHUTDOWN CONTROLS ON AIR HANDLERS AND SUPPLY FANS. SMOKE DETECTORS SHALL BE PROVIDED BY MECHANICAL & INSTALLED BY ELECTRICAL (OR REGISTERED FIRE ALARM COMPANY WHERE APPLICABLE). COORDINATE W/ EQUIPMENT MANUFACTURER & AUTHORITY HAVING JURISDICTION FOR RECOMMENDED MOUNTING LOCATION AND METHOD. COORDINATE TO PROVIDE A COMPLETE SYSTEM. PROVIDE BOTH SUPPLY AND RETURN SIDE DEVICES.

(14) PROVIDE SEVEN DAY PROGRAMMABLE THERMOSTAT, 24 HOUR SINGLE/MULTI STAGE COMMERCIAL THERMOSTAT, DUAL SET POINTS, OCCUPIED AND UNOCCUPIED PERIODS, UNIT OPTIMIZATION, AUTO HEATING/COOLING AND AUTO CHANGE OVER. SUB-BASE BACK-UP BATTERY AND TEMPORARY OVER-RIDE. 24 VAC CONTROL VOLTAGE. PROVIDE PLASTIC SEE THRU PROTECTIVE COVER WITH KEY LOCK.

(15) **FILTER INSTALLATION AND REPLACEMENT**
- A. INSTALL CONSTRUCTION RETURN FILTER AT EACH RETURN GRILLE BEFORE OPERATING PERMANENT AIR HANDLERS DURING CONSTRUCTION.
- B. REPLACE FILTERS AFTER COMPLETING CONSTRUCTION AND BEFORE CONDUCTING BUILDING FLUSH-OUT.
  1. REPLACE CONSTRUCTION RETURN FILTERS WITH FLUSH-OUT RETURN FILTERS.
  2. REPLACE SUPPLY FILTERS.

(16) **PRIOR TO START UP**
- A. CONTRACTOR SHALL FOLLOW THE AIR CONDITIONING EQUIPMENT MANUFACTURER'S STARTUP CHECKLIST.
  1. CONTRACTOR SHALL MAKE SURE THAT ALL DUCTWORK IS CLEAN AND THAT FILTERS ARE PROVIDED FOR EACH UNIT. IF INTERIOR CONDITIONS ARE NOT CLEAN AND AIR BORN DUST IS STILL PRESENT, TEMPORARY FILTERS SHALL BE PROVIDED AT EVERY RETURN AIR GRILLE.

MECHANICAL SYMBOL LEGEND



	SUPPLY AIR GRILLE
	SUPPLY AIR GRILLE-SLOT DIFFUSER
	RETURN AIR GRILLE ALL RETURN AIR DUCT DROPS TO INCLUDE A MANUAL DAMPER
T S O	THERMOSTAT TEMPERATURE SENSOR TEMPERATURE OVERRIDE SENSOR/SWITCH
FD FSD	FIRE DAMPER W/ ACCESSIBLE DUCT ACCESS DOOR FIRE/SMOKE DAMPER W/ ACCESSIBLE DUCT ACCESS DOOR
	FLOW DIRECTION
	PIPE DROP
	PIPE RISE
	RETURN AIR DUCT RISE/DROP
	SUPPLY AIR DUCT RISE/DROP
	WALL OR FLOOR SLEEVE
	CHILLED WATER SUPPLY/RETURN PIPING
SQUARE ROUND	SQUARE TO ROUND DUCT TRANSITION

MECHANICAL ABBREVIATIONS

A/C	AIR CONDITIONED
AD	ACCESS DOOR
AFF	ABOVE FINISHED FLOOR
AHU	AIR HANDLING UNIT
APPROX	APPROXIMATE
ARCH	ARCHITECTURAL
BDD	BACK DRAFT DAMPER
BHP	BRAKE HORSEPOWER
BTU	BRITISH THERMAL UNIT
CFM	CUBIC FEET PER MINUTE
CH	CHILLER
CHP	CHILLED WATER PUMP
CLG	CEILING
CWP	CONDENSER WATER PUMP
CO	CLEANOUT
CT	COOLING TOWER
CU	CONDENSING UNIT
CW	COLD WATER
CL	CENTER LINE
DB	DRY BULB
DIA	DIAMETER
DN	DOWN
DWG	DRAWING
DX	DIRECT EXPANSION
EAT	ENTERING AIR TEMPERATURE
EDH	ELECTRIC DUCT HEATER
EF	EXHAUST FAN
ELEC	ELECTRICAL
ELEV	ELEVATION
F	DEGREES FAHRENHEIT
FC	FAN COIL
FD	FIRE DAMPER W/ DUCT ACCESS DOOR
FLEX	FLEXIBLE
FLG	FLANGE
FLR	FLOOR
FPM	FEET PER MINUTE
FT	FEET, FOOT
FS	FLOW SWITCH
GAL	GALLON
GALV	GALVANIZED
GPM	GALLONS PER MINUTE
HB	HOSE BIBB
HP	HORSEPOWER
HR	HEAT PUMP (WATER SOURCE)
HR	HOUR
HVAC	HEATING/VENTILATING/ AIR CONDITIONING
HWP	HOT WATER PUMP
HZ	HERTZ
ID	INSIDE DIAMETER
IE	INVERT ELEVATION (FLOW LINE)
IN	INCHES
INSUL	INSULATION
IN WG	INCHES OF WATER
KW	KILOWATT(S)
LAT	LEAVING AIR TEMPERATURE
LB	POUND
L	LOUVER
MAX	MAXIMUM
MBD	MANUAL BALANCING DAMPER
MD	MOTORIZED DAMPER
MECH	MECHANICAL
MIN	MINIMUM
MS	MOTOR STARTER
NA	NOT APPLICABLE
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NTS	NOT TO SCALE
OA	OUTSIDE AIR
OAH	OUTSIDE AIR INTAKE HOOD
OBD	OPPOSED BLADE DAMPER
OC	ON CENTER
P	PUMP
PBD	PARALLEL BLADE DAMPER
PP	PRIMARY CHILLED WATER PUMP
PRESS	PRESSURE
PRV	PRESSURE REDUCING VALVE
PSIG	POUNDS PER SQUARE INCH (GAUGE)
R	RETURN (AIR DEVICE)
RA	RETURN AIR
RE: 4M7.01	REFER TO DETAIL 4, SHEET M7.01
RET	RETURN
RH	RELATIVE HUMIDITY
RHD	RELIEF HOOD
RPM	REVOLUTIONS PER MINUTE
RTU	ROOF TOP UNIT
S	SUPPLY (AIR DEVICE)
SA	SUPPLY AIR
SCH	SCHEDULE
SCHP	SECONDARY CHILLED WATER PUMP
SD	SMOKE DAMPER
SEC	SECOND
SF	SUPPLY FAN
SMACNA	SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION
SP	STATIC PRESSURE
SPEC	SPECIFICATION
SF	SQUARE FOOT
STD	STANDARD
TEMP	TEMPERATURE
TSTAT	THERMOSTAT
TYP	TYPICAL
UF	UNDER FLOOR
UH	UNIT HEATER
UL	UNDERWRITERS LABORATORIES
VEL	VELOCITY
VENT	VENTILATE
VF	VENTILATION FAN
VOL	VOLUME
VOLT	VOLTAGE
W	WIDE, WIDTH
W/	WITH
WB	WET BULB
W/O	WITHOUT

TESTING, ADJUSTING & BALANCING

A.	Air Handlers & Roof Top Units:
1.	Test Data: Include design and actual values for the following:
a.	Total airflow rate in CFM.
b.	Total system static pressure in inches w.c.
c.	Discharge static pressure in inches w.c.
d.	Outside airflow in CFM.
e.	Return airflow in CFM.
f.	Outside-air damper position. Damper Position shall be marked with oil-based paint marker
B.	Fan Test:
1.	Test Data: Include design and actual values for the following:
a.	Total airflow rate in CFM.
b.	Total system static pressure in inches w.c.
c.	Discharge static pressure in inches w.c.
d.	Suction static pressure in inches w.c.
C.	Room Grilles, Registers, or Diffusers:
1.	Test Data: Include design and actual values for the following:
a.	Total airflow rate in CFM.
b.	Damper Position shall be marked with oil-based paint marker.

INDEX OF SHEETS MECHANICAL

Sheet Number	Sheet Name
MG01	MECHANICAL NOTES AND LEGEND
MP01	MECHANICAL FLOOR PLAN
MC01	MECHANICAL CONTROLS
MC02	MECHANICAL CONTROLS
MS01	MECHANICAL SCHEDULES
MD01	MECHANICAL DETAILS

MILNET ARCHITECTURAL SERVICES
AMERICAN INSTITUTE OF ARCHITECTS

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ELSA, TX 78543

PROJECT NUMBER
224003

DATE
10-15-24

SHEET NUMBER
MG01

10-15-24

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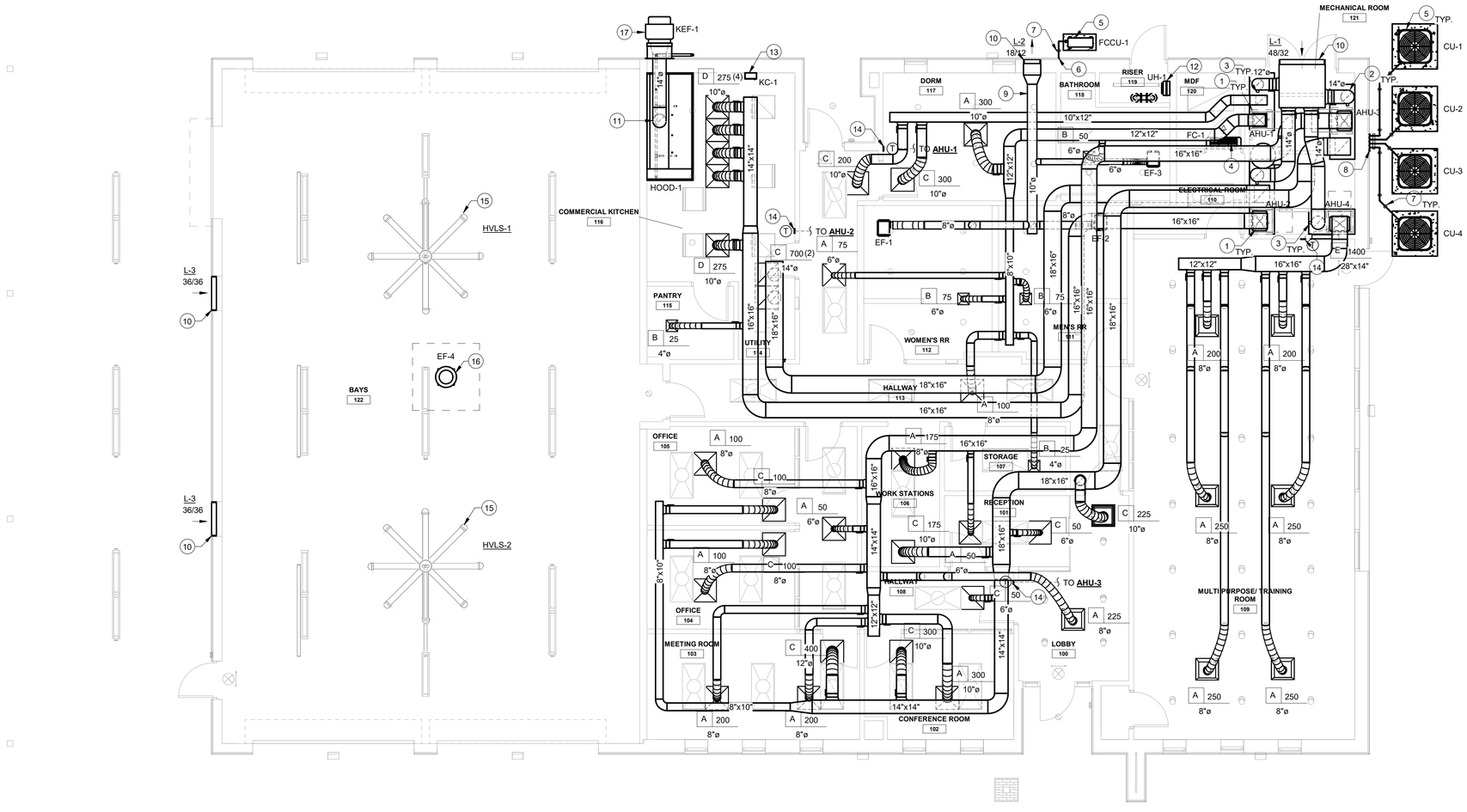
Texas Registered Engineering Firm - F10362

Project number: 24.2.29

STATE OF TEXAS
Wilford L. McGee III
121833

MECHANICAL KEYED NOTES

1	UNIT TO BE MOUNTED ON A 24" HIGH PLATFORM CONSTRUCTED OF 1-1/2" ANGLE IRON/1" SQUARE METAL TUBING. WRAP PLATFORM IN GALVANIZED SHEET METAL. LINE INTERIOR OF PLATFORM W/ 1" DUCT BOARD, W/ FOIL FACING AIRSTREAM. COAT INSIDE W/ MASTIC (TO FACILITATE CLEANING) & SEAL AIR TIGHT.
2	ROUND DUCT FOR OUTSIDE AIR TO BE ROUTED DOWN INTO AIR HANDLER PLENUM.
3	PROVIDE W/ MOTORIZED DAMPER W/ OPEN/CLOSE OPERATION. DAMPER TO BE ACTUATED TO MAX ONLY WHEN COMPRESSOR OR HEATER IS ENERGIZED & ACTUATED TO THE CLOSED POSITION @ ALL OTHER TIMES. PROVIDE W/ ADDITIONAL MANUAL BALANCING DAMPER TO BALANCE CFM AMOUNTS OF OUTSIDE AIR. MECHANICAL CONTRACTOR TO PROVIDE W/ ANY ELECTRICAL HARDWARE TO POWER DAMPER.
4	MOUNT AIR CONDITIONING UNIT CENTERED ABOVE DOOR. REFER TO PLUMBING PAGES FOR CONDENSATE ROUTING.
5	PLACE CONDENSING UNIT ON CONCRETE PAD. ANCHOR UNIT TO CONCRETE PAD AS SHOWN ON DETAIL.
6	PROVIDE W/ REFRIGERANT LINE WALL PENETRATION HOUSING/PANEL EQUAL TO "TGS SERIES PRO SYSTEM KIT" MADE BY "AIREX MANUFACTURING INC". WALL PANEL TO BE SIZED TO ACCOMMODATED REFRIGERANT LINES , COORDINATE W/ ARCH FOR COLOR ,SECURE WITH LOCK-TYPE TAMPER-RESISTANT FASTENERS TO PREVENT UNAUTHORIZED ACCESS. PROVIDE WITH UV/ WEATHER RESISTANT INSULATION PROTECTOR (E-FLEX GUARD). PROVIDE ALUMINUM JACKETING ON ALL LINES EXTERIOR TO THE BUILDING. MOUNT AT 24" A.F.F. ALL PENETRATIONS TO BE CORE DRILLED.
7	PROVIDE ALUMINUM PIPING SUPPORTS AT EVERY 4' FEET. PROVIDE ALUMINUM JACKETING ON ALL LINES EXTERIOR TO THE BUILDING.
8	PROVIDE W/ REFRIGERANT LINE WALL PENETRATION HOUSING/PANEL EQUAL TO "WALL VAULT" MADE BY "ROOF PENETRAITION HOUSINGS, LLC". WALL PANEL TO BE SIZED TO ACCOMMODATED REFRIGERANT LINES & CONDUIT, COORDINATE W/ ELECTRICAL. REFRIGERANT CIRCUIT ACCESS PORTS LOCATED OUTDOORS SHALL BE SECURED WITH LOCK-TYPE TAMPER-RESISTANT CAPS OR SHALL BE OTHERWISE SCORED TO PREVENT UNAUTHORIZED ACCESS. PROVIDE ALUMINUM JACKETING ON ALL LINES EXTERIOR TO THE BUILDING.
9	ROUND EXHAUST DUCT OUT TO LOUVER.
10	COORDINATE LOCATION OF LOUVERS/WALLCAPS TO NOT CONFLICT WITH CONTROL JOINTS AND DOWNSPOUTS.
11	WRAP GREASE DUCT & TOP OF HOOD ABOVE CEILING W/ TWO LAYERS OF "3M FIRE BARRIER DUCT WRAP 615+" OR EQUAL FROM HOOD COLLAR TO FAN ON ROOF.
12	MOUNT UNIT HEATER RECESSED IN WALL OR SURFACE MOUNTED ON WALL, BOTTOM OF UNIT HEATER TO BE AT MINIMUM OF 6'-0" A.F.F. PROVIDE W/ ACCESSORIES AS REQUIRED FOR WALL MOUNTING APPLICATION.
13	PROVIDE WITH NEW KITCHEN CONTROL PANEL TO BE MOUNTED AT THIS LOCATION, 48" A.F.F. CONTROL PANEL TO INCLUDE SYSTEM AND SWITCHES TO CONTROL ASSOCIATED HOOD LIGHTS AND VENTILATION EQUIPMENT, AND TO AUTO-ENGAGE FANS WITH TEMPERATURE INTERLOCKS (IN HOOD). COORDINATE WITH ALL CONSTRUCTION TRADES PRIOR TO MOUNTING.
14	CONTROLS FOR A/C UNIT WILL BE BY MEANS OF A 24 VOLT 7-DAY PROGRAMMABLE THERMOSTAT WITH HEAT-OFF-COOL AND FAN ON-AUTO CAPABILITIES SHOWN ON A DIGITAL DISPLAY WITH 5Â° F DEADBAND AND HAVE SETPOINT OVERLAP RESTRICTIONS. MOUNT THERMOSTAT AT 48" ABOVE FINISHED FLOOR. PROVIDE WITH KEYED CLEAR PLASTIC COVER.
15	HVLS FAN TO BE MOUNTED AT THIS LOCATION, PROVIDE HANGING HARDWARE AS REQUIRED.
16	EXHAUST DUCT TO EXTEND 12" BELOW ROOF DECK. PROVIDE W/ 1/2"X1/2" EXPANDED WIRE MESH OVER DUCT OPENING.
17	MOUNT EXHAUST FANS IN SIDEWALL. PROVIDE WITH ALL HARDWARE AND ACCESSORIES FOR SIDWALL MOUNTING.



1 MECHANICAL FLOOR PLAN
3/16" = 1'-0"

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AIR HANDLING UNIT SCHEDULE

TAG	AHU-1	AHU-2-4
TYPE	SNGL ZN VAV	SNGL ZN VAV
FLOW CONFIGURATION	VERTICAL	HORIZONTAL
AREA SERVED	DORM/ RRs	KITCHEN/ OFFICES
INDOOR UNIT FAN		
SUPPLY CFM	700	1400
MIN. OUTSIDE AIR (CFM)	400	600
EXT. STATIC INCHES WC	0.5	0.5
MIN FAN POWER	1/3 HP - ECM	1.0 HP - ECM
INDOOR UNIT COOLING COIL		
ENTERING AIR DB/WB (°F)	91.24/73.45	86.76/70.69
LEAVING AIR DB/WB (°F	53.39/51.8	54.01/52.71
MIN. TOTAL/SENSIBLE CAPACITY (MBH)	49.25/28.99	79.84/50.23
DESIGN RETURN AIR DB/WB (°F)	73/61	73/61
DESIGN OUTSIDE AIR DB/WB (°F)	105/81	105/81
INDOOR UNIT HEATING SELECTION		
HEATER TYPE/AMBIENT DESIGN DB (°F)	ELEC/30	ELEC/30
HEAT INPUT/STAGES	5 KW/1	10 KW/1
ENTERING/LEAVING DB (°F)	47/70	53/76
DETAILS AND ACCESSORIES		
VOLTAGE/PHASE	208/1	208/3
MCA/MOCP	39.7/40	40.5/45
MANUFACTURER	TRANE	TRANE
MODEL	BCVE024	BCVE048
NOMINAL UNIT SIZE TONNAGE	2.0 TONS	4.0 TONS
MAX WEIGHT (lbs)	170 LBS	175 LBS
NOTES	1-8	1-8

CONDENSING UNIT SCHEDULE

TAG	CU-1	CU-2-4
OUTDOOR UNIT ELECTRICAL		
VOLTAGE/PHASE	208/1	208/3
MCA/MOCP	35/60	36/60
DETAILS AND ACCESSORIES		
MIN COOL/HEAT EFFICIENCY	15 SEER/-	11.2 EER/-
COMPRESSOR QTY/STAGE QTY	1/MOD	1/MOD
COOL/HEAT AMBIENT DB (°F)	105/30	105/30
MANUFACTURER	TRANE	TRANE
MODEL	4TTR5024	TTA090
NOMINAL UNIT SIZE TONNAGE	5.0 TONS	7.5 TONS
MAX WEIGHT	300 lbs	325 lbs
NOTES	6-11	6-11

NOTES:
01. MECHANIC ADJUSTING CONTRACTOR TO PROVIDE ADDITIONAL BELTS & PULLEYS AS NECESSARY SUCH THAT TESTING & BALANCING CAN BE PERFORMED TO THE DESIGN AIR VOLUMES SPECIFIED IN SCHEDULE ABOVE.
02. PROVIDE W/ 2" EZ FILTER RACK BENEATH UNIT.
03. PROVIDE W/ LIQUID LINE FILTER-DRIER, SIZED AT TWICE THE SIZE OF MINIMUM SIZE RECOMMENDATION. LOCATE FILTER-DRIER INSIDE OF AHU/MECH RM, WITHIN 3' OF AHU METERING DEVICE. PROVIDE W/ SIGHT GLASS BETWEEN FILTER-DRIER & METERING DEVICE.
04. PROVIDE AUXILIARY DRAIN PAN W/ CUTOFF FLOAT SWITCH WIRED TO T-STAT. PROVIDE W/ SINGLE POINT POWERED CONDENSATE PUMP. REFER TO PLUMBING SHEETS FOR CONDENSATE ROUTING.
05. PROVIDE W/ FACTORY DUCT SMOKE DETECTOR. REFER TO MANUFACTURER'S INTALLATION MANUAL FOR INSTRUCTIONS. TO BE MOUNTED & WIRED BY MECH CONTRACTOR.
06. PROVIDE W/ SINGLE POINT PWR; TRANE, CARRIER, LENNOX, ACCEPTABLE MFGs.
07. CLEARANCES & SA/RA COLLARS SHOWN ON PLANS ARE FOR SCHEDULED MAKE/MODEL. IF A SUBSTITUTION IS MADE, CONTRACTOR TO BE RESPONSIBLE FOR PROVIDING SA/RA DUCTWORK & CLEARANCES AS PER SUBSTITUTED MANUFACTURER'S REQUIREMENTS.
08. PROVIDE W/ SINGLE ZONE VAV CONTROL.
09. PROVIDE CONDENSER W/ FACTORY HAIL GUARDS & RUBBER ISOLATOR MOUNTING KIT.
10. PROVIDE CONDENSER COIL W/ FACTORY APPROVED E-COAT.
11. PROVIDE CONDENSER WITH FACTORY MOUNTE APR VALVE FOR CAPACITY CONTROL

DX MINI-SPLIT SCHEDULE

INDOOR UNIT TAG	FC-1
SERVES	MDF
LOCATION	WALL
UNIT TYPE	COOLING ONLY
FAN PROPERTIES	
MIN SUPPLY (CFM)	400
MINIMUM O/A (CFM)	0
UNIT CAPACITIES	
ENTERING AIR (DB/WB)	74/62
TOTAL CAPACITY (BTUH	9,000
HEATING CAPACITY (BTUH)	0
UNIT DETAILS	
VOLTAGE/PHASE	208/1
MANUFACTURER	DAIKIN
MODEL NO.	FTK09NMVJU
MAX WEIGHT (LBS)	25
CONDENSING UNIT TAG	**FCCU-1**
DETAILS	
VOLTAGE/PHASE	208/1
MCA/MOCP	13/15
AMB. AIR TEMP. (CLG°F/HTG°F)	100/33
REFRIGERANT	R-410A
COOLING MODE OPER. RANGE	15°F - 110°F
HEATING MODE OPER. RANGE	N/A
MANUFACTURER	DAIKIN
MODEL NO.	RK09NMVJU
MAX WEIGHT (LBS)	75
MIN COOL/HEAT EFFICIENCY	19 SEER/-
MIN EQUIV. LINE LENGTH (FT)	65
MIN VERTICAL RISE (FT)	45
CONTROL TYPE	WL-RC
NOTES	ALL

NOTES:
01. ELECTRICAL CONTRACTOR TO PROVIDE SINGLE CIRCUIT POWER FROM SERVICE TO OUTDOOR UNIT & WIRE TO INDOOR UNIT.
02. PROVIDE W/ WIRED WALL MOUNTED THERMOSTAT W/ OFF-AUTO-ON FUNCTIONALITY. FAN COIL TO BE SET TO AUTO (TURNS FAN OFF WHEN SET-POINT IS REACHED).
03. PROVIDE INDOOR UNITS WITH MOUNTING BRACKETS IF REQUIRED.
04. SEE PLUMBING FOR CONDENSATE ROUTING.
05. CONTRACTOR TO PROVIDE ROOF CURB TO ANCHOR CONDENSER TO.
06. CONTRACTOR TO PROVIDE LINE SETS.
07. SIGHT GLASSES, FILTER DRYERS, & FIELD SUPPLIED EXPANSION VALVES ARE NOT TO BE USED ON THIS EQUIPMENT.
08. INSTALL PER MANUFACTURERS INSTRUCTIONS & PIPING RECOMMENDATIONS.
09. PROVIDE W/ SINGLE POINT POWERED CONDENSATE PUMP, REFER TO PLUMBING SHEETS FOR ROUTING.

FAN SCHEDULE

TAG	EF-1,2	EF-3	EF-4	KEF-1
SERVICE	RRs	RRs	BAYS	KITCHEN
LOCATION	CEILING	CEILING	ROOF	SIDEWALL
FAN PROPERTIES				
CFM	100	75	1,650	1,800
FAN RPM	950	900	1467	1558
EXT SP (IN WG)	0.25	0.15	0.25	1.25
FAN MOTOR SIZE	18 W	18 W	1/2 HP	1 HP
VOLTS/PHASE	120/1	120/1	120/1	120/1
SOUND LEVEL	1.0 SONE	0.6 SONE	13.2 SONES	15 SONES
MOUNTING	CEILING	CEILING	14" TDI CURB	SHORT HOUSING
MANUFACTURER	GREENHECK	GREENHECK	GREENHECK	GREENHECK
MODEL	SP-A110	SP-B80	G-120-VG	CUE-140-VG
MAX WEIGHT	50 lbs	25 lbs	100 lbs	110 lbs
NOTES	1-5	1-5	1-4,6,7	1-3,8-12

NOTES:
01. PROVIDE WITH FACTORY INSTALLED DISCONNECT.
02. PROVIDE W/ FAN SPEED CONTROLLER
03. PROVIDE W/ BACKDRAFT DAMPER.
04. INTERLOCK FAN W/ LIGHTS, PROVIDE STEP UP TRANSFORMER IF LIGHTS ARE AT DIFFERENT VOLTAGE. REFER TO LIGHTING SHEETS.
05. PROVIDE W/ TIMED DELAY SHUTOFF
06. PROVIDE W/ LIFTING LUGS.
07. PROVIDE IBC 2015 COMPLIANT CURB & ATTACHMENTS FROM UNIT TO CURB & CURB TO STRUCTURE. EQUIPMENT OR CURB MANUFACTURER IS RESPONSIBLE FOR PROVIDING ENGINEERED DETAIL ANALYSIS OF:
    A) ATTACHMENT OF EQUIPMENT TO CURB.
    B) CURB TO STRUCTURE.
    C) CURB & ATTACHMENT HARDWARE STRENGTH.
    REFER TO ARCHITECTURAL & STRUCTURAL DRAWINGS FOR ROOF SUBSTRATE DETAILS. EQUIPMENT OR CURB MANUFACTURER IS ALSO RESPONSIBLE FOR PROVIDING ENGINEERED INSTALLATION DRAWINGS FOR ITEMS 'A' & 'B' LISTED ABOVE. BOTH, THE ENGINEERED ANALYSIS & THE ENGINEERED INSTALLATION DRAWINGS SHALL BE PERFORMED SPECIFICALLY FOR THIS BUILDING & PROJECT SITE & STAMPED & SEALED BY A TEXAS LICENSED ENGINEER. SUBMITTALS WILL NOT BE APPROVED UNTIL ALL DOCUMENTATION LISTED ABOVE IS PROVIDED ACCURATELY.
08. FAN TO BE CONTROLLED W/ KITCHEN CONTROL PANEL. PROVIDE W/ TEMPERATURE SENSOR(S) THAT AUTOMATICALLY TURN ON EACH FAN & MAKEUP AIR UNIT FOR EACH HOOD (SECTION).
09. FAN TO BE UL/cUL 762 LISTED - "POWER VENTILATORS FOR RESTAURANT EXHAUST APPLIANCES".
10. PROVIDE W/ ALL HARDWARE/ ACCESSORIES FOR SIDEWALL MOUNTING.
11. PROVIDE FAN W/ NONSTICK COATING & GREASE KIT FOR RESTAURANT APPLICATIONS.
12. FAN DISCHARGE TO BE HORIZONTAL.

KITCHEN HOOD SCHEDULE

TAG	HOOD-1
TYPE	WALL CANOPY
APPLIANCE TYPE	GAS EQUIPMENT
DIMENSIONS	
HOOD LENGTH (IN)	100
HOOD DEPTH (IN)	48
FRONT AIR CURTAIN DEPTH (IN)	0
REAR AIR CURTAIN DEPTH (IN)	0
LEFT AIR CURTAIN DEPTH (IN)	0
RIGHT AIR CURTAIN DEPTH (IN)	0
FIRE SUPPRESSION UTILITY CABINET DEPTH (IN)	12
OVERALL HOOD LENGTH (IN)	112
OVERALL HOOD DEPTH (IN)	48
AIR FLOW DETAILS	
EXAUST CFM	1800
NUMBER OF COLLARS	1
MIN EXHAUST COLLAR AIR SPEED (FPM)	1500
MAKEUP AIR CONFIGURATION	AIR CURTAIN
SUPPLY CFM	0
NUMBER OF COLLARS	0
MANUFACTURER	GREENHECK
MODEL	GXEW
NOTES:	1-14

NOTES
01. PROVIDE PREWIRED FOR POWER AND LIGHTS
02. PROVIDE HANGER BRACKETS.
03. UL 710 LISTED WITHOUT FIRE DAMPER
04. UL TEMPERATURE RATING (600 DEGREES F)
05. PROVIDE INCANDESCENT LIGHT FIXTURES - MIN. 40 FOOT CANDLES
06. GREASE CUP MOUNTED ON LEFT END OF HOOD
07. INTEGRAL 3" AIR SPACE ON HOOD BACK ONLY
08. PROVIDE WITH FIRE SUPPRESSION SYSTEM.
09. PLACE HOOD 78" ABOVE FINISHED FLOOR.
10. PROVIDE W/ TEMPERATURE SENSOR(S) IN HOOD TO AUTO-ENGAGE VENT FANS.
11. PROVIDE W/ FILTERS W/ A SPECIFIED CUT POINT @ 5 MICRONS.
12. PROVIDE W/ BACKSPLASH ON REAR & SIDE(S) OF HOOD (WHERE APPLICABLE).
13. PROVIDE WITH MINI END SKIRTS ON LEFT/RIGHT ENDS OF HOOD (WHERE APPLICABLE).
14. PROVIDE W/ FIRE SUPPRESSION UTILITY CABINET ON END OF HOOD.
15. HOOD SHALL BE UL 710 LISTED. CAPTIVEAIRE. GREENHECK, HALTON ACCEPTABLE MANUFACTURERS.
16. ALL COOKING EQUIPMENT SHALL BE LOCATED NO FARTHER THAN 3" FROM THE BACK WALL TO PROMOTE PROPER CAPTURE OF COOKING EFFLUENTS.

HVLS FAN SCHEDULE

TAG	HVLS-1,2
SERVICE	BAYS
LOCATION	STRUCTURE
DETAILS & ACCESSORIES	
FAN DIAMETER	8 FT
BLADE COUNT	6
MAX FAN RPM	140 RPM
FAN POWER	3/4 HP
VOLTS/PHASE	208/1
MCA/MOCP	4.1/2.5
MAX SOUND LEVEL	55 dBA
FAN WEIGHT	80 LBS
MANUFACTURER	MACRO-AIR
MODEL	AVD 370
NOTES	ALL NOTES APPLY

NOTES:
01. VERIFY EXTENSION TUBE LENGTH & MOUNTING BRACKET WITH MANUFACTURER PRIOR TO ORDERING. COORD MOUNTING SYSTEM.
02. PROVIDE W/ WALL MOUNTED CONTROLS, DIGITAL TOUCH SCREEN, SUITABLE FOR CONTROLLING FAN QUANTITY INDICATED ON PLANS.
03. FAN SHALL BE AMCA CERTIFIED FOR FLOW PERFORMANCE.
04. PROVIDE FAN WITH ONE YEAR FULL LABOR WARRANTY.
05. PROVIDE FAN WITH NON-PRORATED 12 YR PARTS WARRANTY ON MOTOR, DRIVE, ELECTRONIC CONTROLS, & WALL MOUNTED KEYPAD.
06. PROVIDE FAN WITH LIFETIME WARRANTY ON HUB/BLADES.
07. FIRE DISCONNECT TO BE TIED INTO FACP SUCH THAT DURING ALARM EVENTS, FANS ARE DISCONNECTED FROM POWER.
08. MACRO-AIR, BIG ASS FANS, HUNTER, GREENHECK ARE ACCEPTABLE MANUFACTURERS.

UNIT HEATER SCHEDULE

TAG	UH-1
SERVICE/LOCATION	RISER ROOM
DETAILS & ACCESSORIES	
VOLTS/PHASE	208/1
POWER INPUT	1 KW
AMPERAGE	5
MANUFACTURER	MARKEL
MODEL	(3000 series)
NOTES	ALL

NOTES:
01. PROVIDE W/ AUTOMATICE ON/OFF VIA THERMOSTAT.
02. UNIT TO SWITCH ON WHEN SPACE TEMPERATURE REACHES 35°.
03. PROVIDE W/ DISCONNECT.
04. PROVIDE W/ SURFACE MOUNT FRAME

AIR DEVICE SCHEDULE

TAG	A	B	C	D	E
SERVICE TYPE	SUPPLY	SUPPLY	RETURN	SUPPLY	RETURN
PHYSICAL PROPERTIES					
FACE SIZE	24"x24"	12"x12"	24"x24"	24"x24"	SEE PLANS
NECK SIZE	SEE PLANS	SEE PLANS	SEE PLANS	SEE PLANS	SEE PLANS
MOUNTING SURFACE	CEILING	CEILING	CEILING	CEILING	WALL
DETAILS AND ACCESSORIES					
DAMPER TYPE	OPPOSED BLADE	OPPOSED BLADE	OPPOSED BLADE	OPPOSED BLADE	OPPOSED BLADE
ACCESSORY	INSUL BACKPAN	INSUL BACKPAN	INSUL BACK PAN	INSUL BACK PAN	NONE
COLOR FINISH	WHITE	WHITE	WHITE	WHITE	
MATERIAL	STEEL	ALUMINUM	ALUMINUM	ALUMINUM	STEEL
MANUFACTURER	PRICE	PRICE	PRICE	PRICE	PRICE
MODEL	SCD	ASCD	80	APDN	535
NOTES				1,2	1

NOTES:
01. COORDINATE COLOR OF AIR DEVICE & FRAME W/ ARCHITECT.
02. REMOVE AIR PATTERN CONTROLLERS FOR SUPPLY AIR DEVICES SERVING KITCHEN/COOKING/SERVING AREAS.

LOUVER SCHEDULE

TAG	L-1	L-2	L-3
TYPE	INTAKE	EXHAUST	VENTILATION
SERVICE	AHU-1-4	EF-1-3	BAY
DETAILS AND ACCESSORIES			
MAX CFM	2200	275	-
LENGTH/HEIGHT (IN)	48/32	18/12	36/36
FREE AREA (SQ FT)	4.21	0.48	3.57
MAX VELOCITY (FPM)	530	580	-
MAX PRESSURE DROP (IN. H2O)	0.04	0.06	-
FINISH	1.2 mils 70% PVDF	1.2 mils 70% PVDF	1.2 mils 70% PVDF
INCLUDED SCREENS	BIRD	BIRD	BIRD
ACTUATION TYPE	NONE	NONE	NONE
BORDER STYLE	2" FLANGE	2" FLANGE	2" FLANGE
MAUNUFACTURER	GREENHECK	GREENHECK	GREENHECK
MODEL	EHH-501X	ESD-435X	EHH-501X
NOTES	1,2,3,4	1,2,3,4	1,2,3,4

NOTES:
01. LOUVER OPENINGS TO BE SAW CUT.
02. SEAL OPENING WEATHER TIGHT.
03. LOUVER TO BE FLORIDA STATE APPROVED
04. TO BE AMCA 540 & 550 LISTED

AIR BALANCE SCHEDULE

MARK	O.A. IN (+)	E.A. OUT (-)	BALANCE (+/-)
AHU-1	400		
AHU-2	600		
AHU-3	600		
AHU-4	600		
EF-1		100	
EF-2		100	
EF-3		75	
KEF-1		1,800	
TOTAL	**2,200**	**2,075**	**(+) 125**

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Texas Registered Engineering Firm - F10362
Project number: 24.2.29

10-15-24

STATE OF TEXAS
Wilford L. McGee III
121939
REGISTERED
PROFESSIONAL ENGINEER

MILNET ARCHITECTURAL SERVICES
AMERICAN INSTITUTE OF ARCHITECTS

REMOTE OPERATIONS CENTER
PRECINCT 1
THE COUNTY OF HIDALGO
708 E. EDINGBURG AVE.
ELSA, TX 78543

PROJECT NUMBER
224003

DATE
10-15-24

SHEET NUMBER
MS01

HOOD INFORMATION

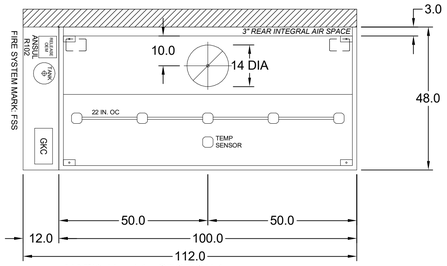
HOOD NO.	MARK	MODEL	HOOD DIMENSIONS (IN.)			HOOD CONSTR.	COOKING LOAD / DUTY RATING	EXHAUST						SUPPLY		HANGING WEIGHT LBS.	SECTION LOCATION
			LENGTH	WIDTH	HEIGHT			TOTAL CFM	COLLAR(S)					MUA CFM	AC CFM		
									WIDTH	LENGTH	DIA.	CFM	S.P.				
1	HOOD 1	GXEW-100-S	100	48	24	4;430 SS WHERE EXPOSED	4;HEAVY	1800			14	1800	0.582			4;484	SINGLE

HOOD INFORMATION

HOOD NO.	MARK	LIGHTING DETAILS			GREASE FILTRATION DETAILS				UTILITY CABINET(S)				
		FIXTURE TYPE BULB / LAMP INFO	QTY	FOOT CANDLES	TYPE / MODEL MATERIAL	QTY	SIZE (IN.)		LOCATION	FIRE SYSTEM		CONTROLS	
							L	H		TYPE	SIZE	MODEL	INTERFACE
1	HOOD 1	INCANDESCENT (GLOBE) 100W A19 (BULBS NOT INCL.)	5	48.51	X-TRACTOR/SPARK ARRESTOR INCL.) STAINLESS STEEL	5	16	20	LEFT	ANSUL R102	3	GKC	TOUCHSCREEN
						1	20						

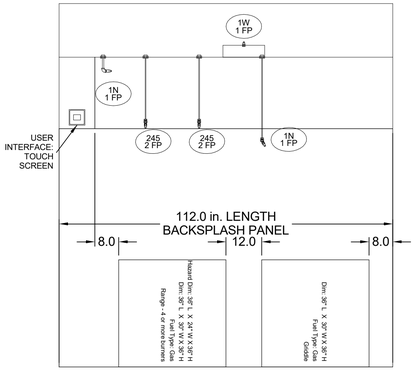
HOOD OPTIONS

- UL 710 LISTED W/ OUT EXHAUST FIRE DAMPER - UL #MH11726
- BACK INTEGRAL AIR SPACE - 3 IN WIDE
- 18 IN HIGH CEILING ENCLOSURES - FRONT LEFT RIGHT - FIELD INSTALLED
- FACTORY MOUNTED EXHAUST COLLAR(S)
- BACKSPLASH 80.00 IN HIGH 112.00 IN LONG
- PERFORMANCE ENHANCING LIP (PEL) TECHNOLOGY
- STANDING SEAM CONSTRUCTION FOR SUPERIOR STRENGTH

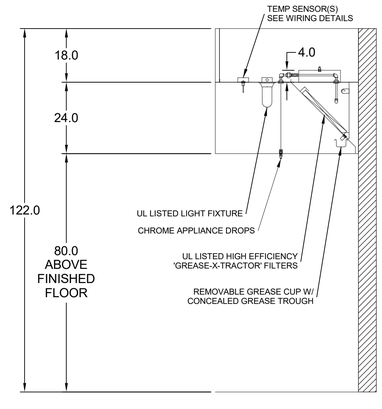


MARK: Hood 1 - SECTION 1
PLAN VIEW

Fire (piping/drops/nozzles/etc.) subject to change. As built's can be provided at time of order and included with product shipment

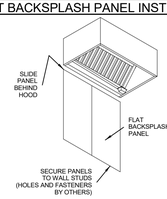


MARK: Hood 1 - SECTION 1
ELEVATION VIEW

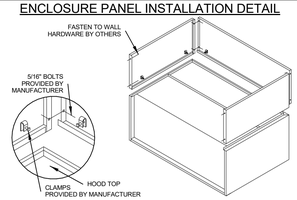


MARK: Hood 1
SECTION VIEW

FLAT BACKSPLASH PANEL INST. DETAIL



ENCLOSURE PANEL INSTALLATION DETAIL



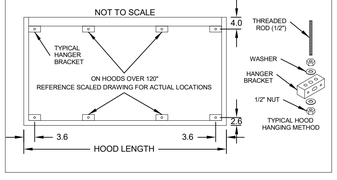
HOOD HANGING HEIGHT FOR FIRE SYSTEMS

VERIFICATION OF HOOD HANGING HEIGHT ABOVE FINISHED FLOOR (A.F.F.) IS REQUIRED FOR CORRECT PLACEMENT OF FIRE SYSTEM NOZZLES.

☐ RECOMMENDED HANGING HEIGHT = 80" FROM FINISHED FLOOR TO LOWER FRONT EDGE OF HOOD.

☐ OTHER HANGING HEIGHT = _____" FROM FINISHED FLOOR TO LOWER EDGE OF HOOD.

HOOD HANGER BRACKET DETAIL



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STATE OF TEXAS
Willford L. McGee III
121939
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CONTROL INFORMATION

MARK	ELECTRICAL CONTROL PACKAGE		USER INTERFACE	
	MODEL	LOCATION	TYPE	LOCATION
CONTROLS	GKC-CV-S-10-1-1-0	LEFT CABINET ON HOOD 1	FULL COLOR TOUCHSCREEN	CABINET – LEFT CABINET ON HOOD 1

FANS CONTROLLED											
FAN #	TYPE	FAN	FAN MARK	ZONE	CFM	MOTOR HP	MOTOR VOLT	CYCLE	MOTOR PHASE	MOTOR STARTER IN PANEL	VFD IN PANEL
1	EXHAUST	E1	KEF-1	1	1800	1	115	60	1	NO	NO

CONTROL FEATURES

- HOOD LIGHT CONTROL
- TEMP SENSORS (FACTORY INSTALLED) - QTY. 1
- DRY FIRE CONTACTS - QTY. 1
- LIGHTS OFF DURING FIRE
- EXHAUST MAX DURING FIRE
- SUPPLY OFF DURING FIRE

DOC NUMBER: #### | REV: ####

CAUTION
UNIT MUST BE GROUNDED IN ACCORDANCE WITH N.E.C. POWER MUST BE OFF WHILE SERVICING.

ATTENTION
L'APPAREIL DOIT ÊTRE MIS À LA TERRE CONFORMÉMENT AU CODE C.E. L'ALIMENTATION DOIT ÊTRE COUPÉE DURANT L'ENTRETIEN.

c UL us LISTED 43BM
COMMERCIAL APPLIANCE OUTLET CENTER
ELECTRICAL RATINGS: 110-240V,1PHASE, 50 -60HZ,15A
BASE FILE #E200616, ML FILE #E313951

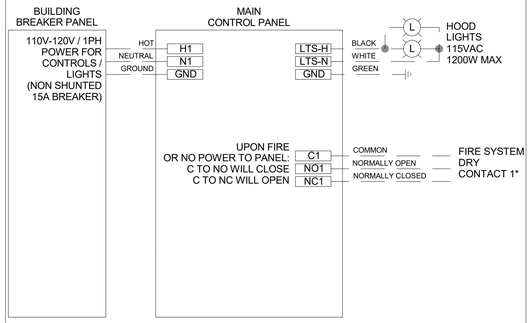
THESE DRAWINGS SHALL NOT BE REMOVED FROM THIS EQUIPMENT. USE COPPER CONDUCTORS RATED TO 90°C UNLESS SPECIFIED. TORQUE CONTROL & GROUND BLOCKS TO 6 LBS. IN. TORQUE POWER LUGS/SCREWS TO COMPONENT RATINGS LISTED. TORQUE CONTROL BOARD SCREW TERMINALS TO 3.5 LBS. IN. FIELD CONTROL WIRING RESISTANCE SHOULD NOT EXCEED 0.75 OHM. SEE IOM FOR ADDITIONAL INFORMATION, OR CALL FACTORY AT 1-800-371-6858.

PRG VERSION: V4
FIELD WIRED (CÂBLÉ LOCALEMENT) ——
FACTORY WIRED (CÂBLÉ À L'USINE) ——

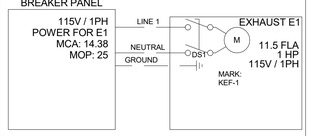
NE PAS RETIRER CES DESSINS DE CET ÉQUIPEMENT. SAUF INDICATION CONTRAIRE, UTILISER DES CONDUCTEURS EN CUIVRE CLASSÉS 90 °C. SERRER LES BORNES DE COMMANDE ET DE MISE À LA TERRE À 6 LB-PO. SERRER LES COSSES/VIS D'ALIMENTATION AUX COUPLES INDIQUÉS POUR LE COMPOSANT. SERRER LES BORNES À VIS DE LA CARTE DE COMMANDE À 3,5 LB-PO. LA RÉSISTANCE DU CÂBLAGE DE COMMANDE LOCAL NE DOIT PAS DÉPASSER 0,75 OHM. POUR PLUS D'INFORMATION, CONSULTER LE MANUEL OU APPELER 1-800-371-6858

WIRING DIAGRAM CODE: ####
JOB NAME: HIDALGO COUNTY REMOTE OPERTATION KVS
MODEL: GKC-CV-S-10-1-1-0
SERIAL NUMBER: WDSN#
MARK: CONTROLS

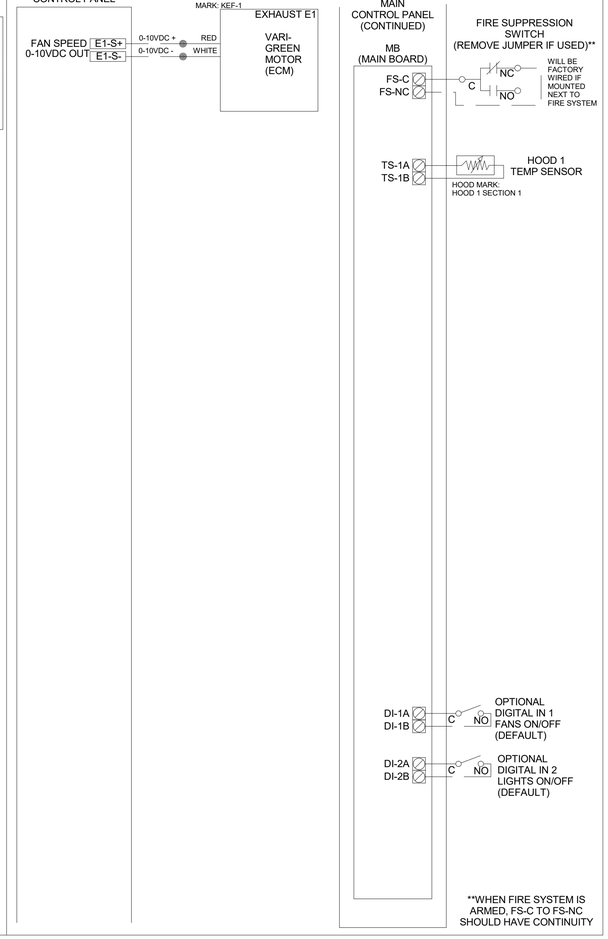
POWER WIRING FOR KITCHEN CONTROLS
(WIRING TO BE DONE BY ELECTRICIAN)



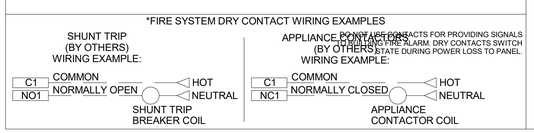
POWER WIRING FROM BREAKER PANEL DIRECT TO FANS
(WIRING TO BE DONE BY ELECTRICIAN)



CONTROL WIRING FOR KITCHEN CONTROLS
(WIRING TO BE DONE BY ELECTRICIAN, IF NO CONTROLS CONTRACTOR. USE 18-22GA WIRE UNLESS SPECIFIED.)



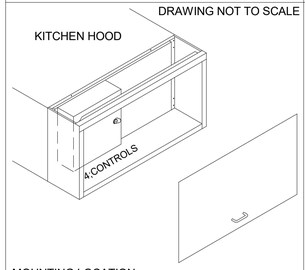
*FIRE SYSTEM DRY CONTACT WIRING EXAMPLES



DO NOT USE CONTACTS FOR PROVIDING SIGNALS TO CONTACT FIRE ALARM. DRY CONTACTS SWITCH STATE DURING POWER LOSS TO PANEL.

CABINET DETAILS

DRAWING NOT TO SCALE



MOUNTING LOCATION:
UTILITY CABINET ON HOOD
(INNER CONTROL BOX: 12 X 20 X 6)

NOTES:
1) WHEN CONTROLS ARE MOUNTED IN HOOD-MOUNTED OR WALL-MOUNTED UTILITY CABINET, FOR HOOD OR WALL CABINET DIMENSIONS SEE HOOD SUBMITTAL.

2) MINIMUM OF 36" OF CLEARANCE RECOMMENDED IN FRONT OF CONTROL CABINET

USER INTERFACE DETAILS

MOUNTING TYPE
FACTORY MOUNTED:
UTILITY CABINET - LEFT END OF HOOD

USER INTERFACE CONTROL
FANS AND LIGHTS

INTERFACE CABLE LENGTH
7FT (FACTORY PROVIDED)

ZONE CONFIGURATION

ZONE #	ZONE	ROOM TEMP
1	Z1	PRESET

HOOD CONFIGURATION

HOOD #	HOOD	HOOD MARK	ZONE	EXHAUST	SUPPLY	MB-TEMP SENSORS	HCB
1	H1	HOOD 1 SECTION 1	Z1	E1		TS1	NO

WIRING DIAGRAM CODE: ####
JOB NAME: HIDALGO COUNTY REMOTE OPERTATION KVS
MODEL: GKC-CV-S-10-1-1-0
SERIAL NUMBER: WDSN#
MARK: CONTROLS
DOC NUMBER: #### | REV: ####

DEFAULT SETTINGS / PARAMÈTRES PAR DÉFAUT

FACTORY SETTINGS
TYPE: CV
CONFIGURATION: STANDARD
ZONES: 1
HOODS: 1
SUMPS: 0
EXHAUST FANS: 1
SUPPLY FANS: 0
MB ROOM SENSOR: NO
MB TEMP SENSORS: 1
HIGH TEMP FAULT: NO
FREEZE PROTECTION: YES
GAS RESET: NO
FAN PROVING: NO
BMS: NONE

ZONE SETTINGS
SEE ZONE CONFIGURATION IN TABLE ON LEFT

HOOD SETTINGS
SEE HOOD CONFIGURATION IN TABLE ON LEFT

EXHAUST FAN SETTINGS
SEE FAN CONFIGURATION IN TABLE ON LEFT

SUPPLY FAN SETTINGS 4:
SEE FAN CONFIGURATION IN TABLE ON LEFT

SENSOR SETTINGS
SEE HOOD CONFIGURATION IN TABLE ON LEFT

USER INTERFACE SETTINGS (MB) 4:
FAN & LIGHT BUTTONS: SHOW BOTH (SEPERATE)

USER INTERFACE SETTINGS (HCB)
NA

GENERAL SETTINGS 4:
TIME ZONE: CENTRAL DAYLIGHT (DEFAULT)

FIRE/FAULT SETTINGS 4:
EXHAUST DURING FIRE: MAX
SUPPLY DURING FIRE: OFF
LIGHTS DURING FIRE: OFF

BMS SETTINGS
NA

PRG VERSION: V4

FAN CONFIGURATION

FAN #	TYPE	FAN	FAN MARK	ZONE	MIN CFM	MAX CFM	MODBUS VFD	VFD ADDRESS	MIN FREQ.	MAX FREQ.	MIN VDC	MAX VDC
1	EXHAUST	E1	KEF-1	Z1	-	1800	NO	-	-	-	-	9.0

10-15-24

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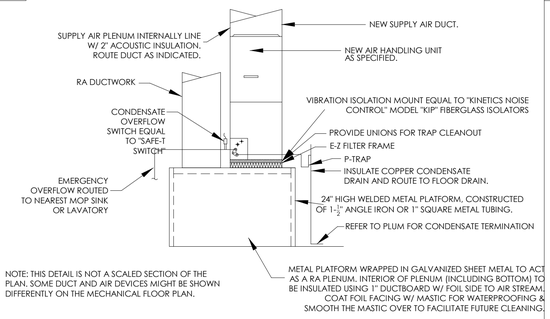
SHEET NUMBER
MC02

01



AIR HANDLING UNIT CONFIGURATION
NOT TO SCALE

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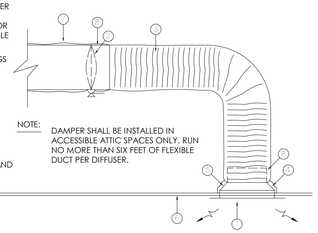
02

1. CEILING DIFFUSER
2. ROUND MANUAL BALANCING DAMPER WITH FACTORY MOUNTED LOCKING HAND QUADRANT FLEXMASTER SLD OR EQUAL. DAMPER SIZE SAME AS FLEXIBLE DUCT SIZE.
3. FLEXIBLE ROUND DUCT. SEE DRAWINGS FOR SIZES. BY FLEXMASTER.
4. INSULATE BACK PAN OF DIFFUSER.
5. DIFFUSER
6. CEILING
7. ROUND METAL WRAPPED DUCT WITH INSULATION
8. PROVIDE TIE STRAP ON BOTH INNER AND OUTER SLEEVES ON FLEX DUCT.



NOTE: DAMPER SHALL BE INSTALLED IN ACCESSIBLE ATTIC SPACES ONLY. RUN NO MORE THAN SIX FEET OF FLEXIBLE DUCT PER DIFFUSER.

DIFFUSER RUN OUT DETAIL
NO SCALE

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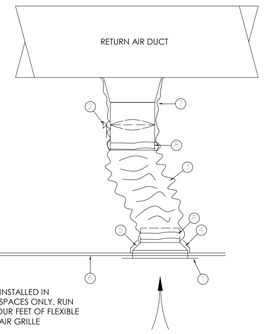
03

1. RETURN AIR GRILLE
2. ROUND MANUAL BALANCING DAMPER WITH FACTORY MOUNTED LOCKING HAND QUADRANT FLEXMASTER SLD OR EQUAL. DAMPER SIZE SAME AS FLEXIBLE DUCT SIZE.
3. FLEXIBLE ROUND DUCT, FOUR FEET OR LESS. SEE DRAWINGS FOR SIZES. BY FLEXMASTER
4. INSULATE BACK PAN OF GRILLE.
5. FIELD FABRICATED SQUARE TO ROUND TRANSITION. FROM NECK OF GRILLE TO SIZE INDICATED ON PLAN.
6. CEILING (SEE PLANS FOR CEILING TYPE)
7. ROUND METAL WRAPPED DUCT WITH INSULATION
8. PROVIDE TIE STRAP ON BOTH INNER AND OUTER SLEEVES ON FLEX DUCT.



NOTE: DAMPER SHALL BE INSTALLED IN ACCESSIBLE ATTIC SPACES ONLY. RUN NO MORE THAN FOUR FEET OF FLEXIBLE DUCT PER RETURN AIR GRILLE

RETURN AIR GRILLE ATTACHMENT DETAIL
NO SCALE

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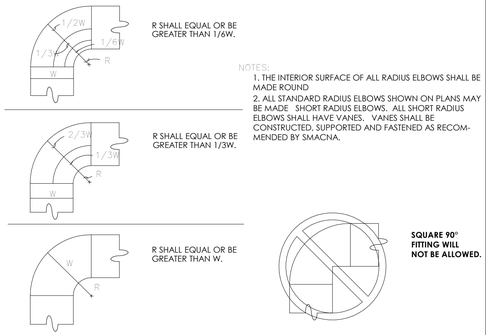
04



NOTES:
1. THE INTERIOR SURFACE OF ALL RADIUS ELBOWS SHALL BE MADE ROUND
2. ALL STANDARD RADIUS ELBOWS SHOWN ON PLANS MAY BE MADE SHORT RADIUS ELBOWS. ALL SHORT RADIUS ELBOWS SHALL HAVE VANES. VANES SHALL BE CONSTRUCTED, SUPPORTED AND FASTENED AS RECOMMENDED BY SMACNA.

RADIUS DUCT ELBOW DETAIL
NO SCALE

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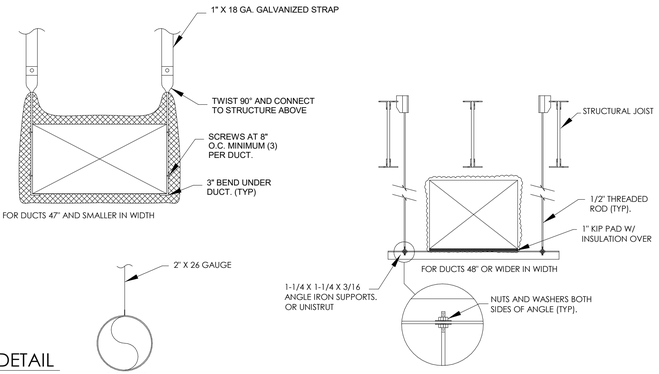
05

DUCT SUPPORT:
1. HANGER ATTACHMENTS TO STRUCTURE: SEE DIVISION 23 SECTION "HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT". MINIMUM ROD OR BOLT SIZE 3/8(9MM).
2. SUSPEND HORIZONTAL GALVANIZED RECTANGULAR DUCTWORK 47" (1220MM) OR LESS IN LARGEST DIMENSION FROM CONSTRUCTION BY 1 INCH BY 18 GAUGE (25MM X 1.3MM) GALVANIZED STRAP HANGERS SCREWED 8 INCHES (200MM) O.C. TO DUCTS. USE THREE (3) SCREWS MINIMUM PER STRAP. BEND STRAP UNDER DUCT AND SCREW INTO BOTTOM OF DUCT.
3. SUSPEND HORIZONTAL RECTANGULAR STAINLESS STEEL AND COATED DUCTWORK 48" (1220MM) OR LESS IN LARGEST DIMENSION FROM CONSTRUCTION BY 1 INCH BY 18 GAUGE (25MM BY 1.3MM) GALVANIZED STEEL STRAP HANGERS BOLTED TO MATING FLANGES AT MINIMUM OF THREE LOCATIONS. (TOP,MIDDLE,BOTTOM).
4. DUCTS OVER 48" (1220MM) IN LARGEST DIMENSION SUPPORT FROM UNISTRUT, SUPERSTRUT, OR EQUAL, TRAPEZE HANGERS SIZED FOR THE LOAD, PER SMACNA STANDARDS.
5. SUPPORT ROUND STEEL DUCTWORK FROM CONSTRUCTION BY 1 INCH BY 18 GUAGE (25MM BY 1.3MM) GALVANIZED STRAP HANGERS WITH INSIDE RADIUS OF LOOP HANGER EQUAL TO OUTSIDE RADIUS OF DUCT. FOR DUCTS UNDER 12" DIAMETER, PROVIDE SUPPORTS 10 FEET (3CM) O.C; 12 FEET (3.6M) AND OVER, 6 FEET (1.8M) O.C. PROVIDE NOT LESS THAN ONE HANGER PER BRANCH AND AT EACH CHANGE OF DIRECTION.
6. SUPPORT ROUND FLEXIBLE DUCTWORK FROM CONSTRUCTION BY 2 INCHES BY 26 GAUGE (50 MM BY 0.55MM) GALVANIZED STRAP HANGERS WITH INSIDE RADIUS OF LOOP HANGER EQUAL TO OUTSIDE RADIUS OF DUCT. LOCATE SUPPORTS TO AVOID KINKS AND SHARP BENDS.
7. DOUBLE FOLD STRAPS AT ATTACHMENTS TO STRUCTURE.
8. SPACE HANGERS NOT OVER 96 INCHES (2440MM) ON CENTER FOR DUCTS SMALLER THAN 18 INCHES (457MM) IN LARGEST DIMENSION; 60 INCHES (1524MM) O.C. FOR DUCTS 18 INCHES (457MM) AND OVER.



DUCT HANGER DETAIL
NO SCALE

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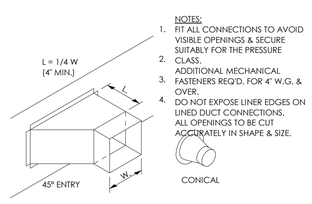
06



NOTES:
1. FIT ALL CONNECTIONS TO AVOID VISIBLE OPENINGS & SECURE SUITABLY FOR THE PRESSURE
2. CLASS. ADDITIONAL MECHANICAL
3. FASTENERS REQ'D. FOR 4" W.G. & OVER.
4. DO NOT EXPOSE LINER EDGES ON LINED DUCT CONNECTIONS. ALL OPENINGS TO BE CUT ACCURATELY IN SHAPE & SIZE.

BRANCH CONN. DETAIL
NO SCALE

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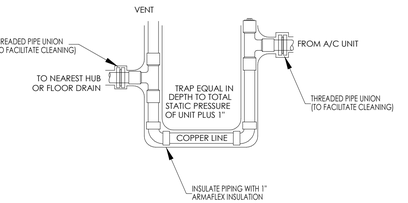
07



CONDENSATE TRAP DETAIL
NO SCALE

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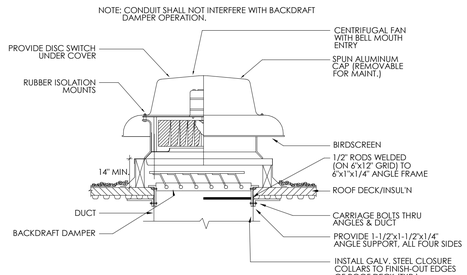
08



ROOF MTD. EXHAUST FAN
NO SCALE

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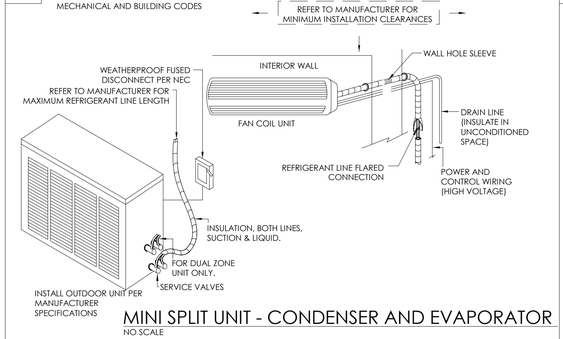
09

MINI SPLIT HEAT PUMP SYSTEM TO BE INSTALLED ACCORDING TO ALL APPLICABLE NATIONAL AND LOCAL ELECTRICAL, MECHANICAL AND BUILDING CODES



MINI SPLIT UNIT - CONDENSER AND EVAPORATOR
NO SCALE

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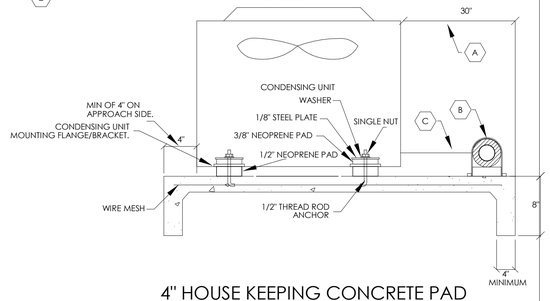
A. PROVIDE 30" MINIMUM FOR UNIT MAINTENANCE CLEARANCE AND REFRIGERANT LINE ROUTING
B. ANCHOR REFRIGERANT LINES WITH GALVANIZED UNISTRUT W/ PIPE CLAMP
C. PROVIDE ALL REFRIGERANT LINES WITH 2" ARMAFLEX INSULATION



4" HOUSE KEEPING CONCRETE PAD
NO SCALE

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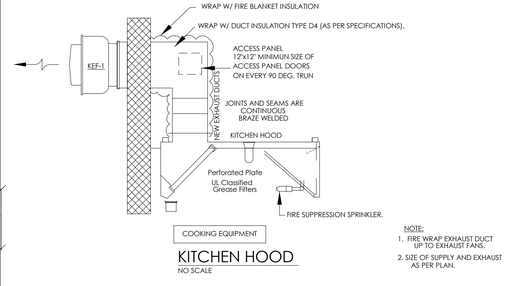

NOTE:
1. FIRE WRAP EXHAUST DUCT UP TO EXHAUST FANS.
2. SIZE OF SUPPLY AND EXHAUST AS PER PLAN.

KITCHEN HOOD
NO SCALE

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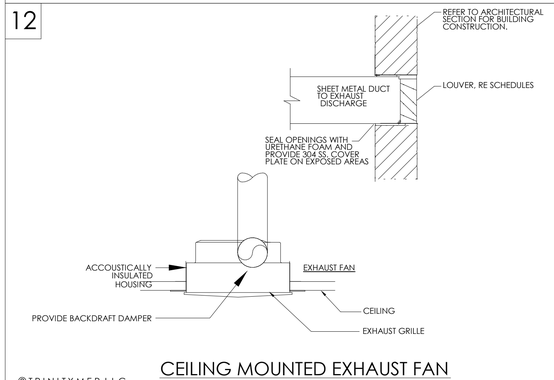

CEILING MOUNTED EXHAUST FAN
NO SCALE

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Project number: 24.2.29

10-15-24

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Willford L. McGee III
121939
REGISTERED PROFESSIONAL ENGINEER

MILNET ARCHITECTURAL SERVICES
AMERICAN INSTITUTE OF ARCHITECTS

REMOTE OPERATIONS CENTER PRECINCT 1
THE COUNTY OF HIDALGO
708 E. EDINGBURG AVE.
ELSA, TX 78543

PROJECT NUMBER
224003

DATE
10-15-24

SHEET NUMBER
MD01

ELECTRICAL LEGEND-LIGHTING

---ALL SYMBOLS SHOWN MAY NOT APPEAR IN ALL DRAWINGS.
SYMBOLS ARE SHOWN SCHEMATIC AND MAY NOT BE TO SCALE.

SYMBOL	DESCRIPTION
	2'x4' LIGHT FIXTURE, REFER TO LUMINAIRE SCHEDULE
	2'X4' LIGHT FIXTURE W/EMERGENCY BATTERY PACK, REFER TO LUMINAIRE SCHEDULE
	2'x2' LIGHT FIXTURE, REFER TO LUMINAIRE SCHEDULE
	2'X2' LIGHT FIXTURE W/EMERGENCY BATTERY PACK, REFER TO LUMINAIRE SCHEDULE
	4' LIGHT FIXTURE, REFER TO LUMINAIRE SCHEDULE
	TRACK LIGHT WITH HEADS AS INDICATED
	INCANDESCENT, LED, FLUORESCENT, OR HID WALL WASHER LIGHT FIXTURE CEILING MTD, REFER TO LUMINAIRE SCHEDULE
	INCANDESCENT, LED, FLUORESCENT, OR HID FIXTURE CLG, OR WALL MTD, REFER TO LUMINAIRE SCHEDULE
	LED, FLUORESCENT, OR HID FIXTURE WITH EMERGENCY BATTERY PACK, CLG, OR WALL MTD, REFER TO LUMINAIRE SCHEDULE
	EXIT LIGHT, CEILING OR WALL MOUNTED - SHADING INDICATING SINGLE OR DOUBLE FACE; DIRECTIONAL ARROWS AS INDICATED REFER TO LUMINAIRE SCHEDULE
	EXIT LIGHT SAME AS ABOVE, EXCEPT WITH AN EMERGENCY UNIT AS A COMBO, REFER TO LUMINAIRE SCHEDULE
	CEILING FAN, REFER TO SCHEDULE
	STRIP UTILITY LIGHT FIXTURE, REFER TO LUMINAIRE SCHEDULE
	STRIP UTILITY STRIP LIGHT WITH EMERGENCY BATTERY PACK, REFER TO LUMINAIRE SCHEDULE
$	WALL SWITCH SPST, 20A,120/277V
$2	DOUBLE POLE TOGGLE SWITCH, 20A/120/277V
$3	3-WAY WALL SWITCH, 20A,120/277V
$4	4-WAY WALL SWITCH, 20A,120/277V
$D	WALL DIMMER SWITCH
$P	WALL SWITCH SPST, 20A,120/277V - PILOT LIGHT SWITCH
$K (X)	WALL SWITCH SPST, 20A,120/277V - KEYED SWITCH, X = 3 OR 4 WAY

ELECTRICAL LEGEND-SPECIAL SYSTEMS

---ALL SYMBOLS SHOWN MAY NOT APPEAR IN ALL DRAWINGS.
SYMBOLS ARE SHOWN SCHEMATIC AND MAY NOT BE TO SCALE.

SYMBOL	DESCRIPTION	
V	WALL MOUNTED VOICE/DATA OUTLET. FURNISH AND INSTALL 1.25"C., WITH PULLSTRING AND INSULATED BUSHING, STUBBED ABOVE CEILING. +24" UNLESS OTHERWISE NOTE. BOX TO BE MINIMUM 2 1/8" DEEP.	
V PR	CEILING MOUNTED VOICE/DATA OUTLET. FURNISH AND INSTALL 1.25"C., WITH PULLSTRING AND INSULATED BUSHING	
▼	WALL MOUNTED VOICE OUTLET. FURNISH AND INSTALL 1"C , WITH PULLSTRING AND INSULATED BUSHING, STUBBED ABOVE CEILING. +24" UNLESS OTHERWISE NOTE. BOX TO BE MINIMUM 2 1/8" DEEP.	
▽	WALL MOUNTED DATA OUTLET. FURNISH AND INSTALL 1.25"C , WITH PULLSTRING AND INSULATED BUSHING, STUBBED ABOVE CEILING. +24" UNLESS OTHERWISE NOTE. BOX TO BE MINIMUM 2 1/8" DEEP.	
P ▼	PUBLIC TELEPHONE OUTLET.; J-BOX & 1"C	
TV	TELEVISION/MEDIA OUTLET. CLG. OR WALL MOUNTED - STUB 1" C. ABOVE CEILING FROM OUTLET BOX	
	PUSHBUTTON WALL MOUNTED - J-BOX WITH 3/4"C.	
AV	AUDIO VIDEO DROP, REFER TO DETAIL	
IC	INTERCOM - CALL SWITCH- JBOX WITH 3/4"C	
S	INTERCOM/PAGING CEILING LAY-IN SPEAKER	
	PA EXTERIOR SPEAKER - WALL MTD, J-BOX W/3/4"C	10'-6" AFF
	SECURITY DOOR CONTACT SENSOR - STUB 1/2"C ABOVE CEILING FROM OUTLET BOX	
	SECURITY MOTION DETECTOR SENSOR - STUB 1/2"C ABOVE CEILING FROM OUTLET BOX	
	SECURITY GLASS BREAK SENSOR - STUB 1/2"C ABOVE CEILING FROM OUTLET BOX	
	SECURITY KEY PAD - STUB 3/4"C ABOVE CEILING FROM OUTLET BOX	
SEC	SECURITY PANEL JUNCTION BOX	54"
ACC	ACCESS CONTROL PANEL JUNCTION BOX - BY OTHERS	54"
	CARD READER BOX - STUB 3/4"C ABOVE CEILING LEVEL FROM OUTLET BOX SYSTEM BY OTHERS	----
	MAGNETIC LOCK BOX - STUB 3/4"C ABOVE CEILING LEVEL FROM OUTLET BOX SYSTEM BY OTHERS	----
	INTRUSION EXTERIOR SPEAKER - JBOX WITH 3/4"C	10'-6" AFF
C	SINGLE SIDED CLOCK, DIGITAL CLOCK- J-BOX W/3/4"C	96" AFF MIN.
C	DOUBLE SIDED CLOCK,DIGITAL CLOCK -J-BOX W/3/4"C	96" AFF MIN.
	INTERIOR CAMERA J-BOX W/ 1" CONDUIT TO SERVER RM.	----
WP	EXTERIOR CAMERA J-BOX W/ 1" CONDUIT TO SERVER RM.	----
	360° CLG. MTD. CAMERA - J-BOX WITH 1"C TO SERVER RM.	----
	TELEPHONE BOARD- 3/4"X8'x8' FIRE RATED	----
AP	WIRELESS ACCESS POINT, J-BOX W/ 1" CONDUIT TO SERVER RM.	----

ELECTRICAL LEGEND-FIRE ALARM

---ALL SYMBOLS SHOWN MAY NOT APPEAR IN ALL DRAWINGS.
SYMBOLS ARE SHOWN SCHEMATIC AND MAY NOT BE TO SCALE.

SYMBOL	DESCRIPTION
F	FIRE ALARM PULL STATION: STUB 3/4"C ABOVE CEILING FROM J-BOX
AV	FIRE ALARM AUDIBLE/VISUAL SIGNAL: STUB 3/4"C ABOVE CEILING FROM J-BOX
V	FIRE ALARM VISUAL SIGNAL: STUB 3/4"C ABOVE CEILING FROM J-BOX
V	FIRE ALARM CEILING MOUNT SPEAKER STROBE, UL LISTED, : J-BOX WITH 3/4"C
VS	FIRE ALARM WALL MOUNT OUTDOOR SPEAKER STROBE, UL LISTED, : J-BOX WITH 3/4"C
V S	FIRE ALARM CEILING WALL MOUNT INDOOR SPEAKER STROBE, UL LISTED, : J-BOX WITH 3/4"C
S	FIRE ALARM SMOKE DETECTOR CEILING OR WALL MOUNTED: STUB 3/4"C ABOVE CEILING FROM J-BOX
H	HEAT DETECTOR CEILING OR WALL MOUNTED: STUB 3/4"C ABOVE CEILING FROM J-BOX
S D	DUCT SMOKE DETECTOR: STUB 3/4"C ABOVE CEILING FROM J-BOX
SD A	SMOKE DETECTOR WITH AN AUDIBLE BASE: STUB 3/4"C ABOVE CEILING FROM J-BOX
FACP	FIRE ALARM CONTROL PANEL WITH EMERGENCY VOICE SYSTEM, ADDRESSABLE, FLUSH MTD UNO, INCLUDE A FIRE DOCUMENT BOX EQUAL TO MFR. SPACE AGE ELECTRONICS #FDB-ACE-11.
EVES	FIRE ALARM EMERGENCY VOICE EVACUATION SYSTEM, FLUSH OR SURFACE.
FAAP	FIRE ALARM REMOTE ANNUNCIATOR PANEL, FLUSH MOUNTED UNO
PAD-X	POWER SUPPLY, DEDICATED 110V IN MECH/ELEC RM.
DH	DOOR HOLDER DEVICE: STUB 3/4"C ABOVE CEILING FROM J-BOX
TS	TAMPER SWITCH: STUB 3/4"C ABOVE CEILING FROM J-BOX
FS	FLOW SWITCH: STUB 3/4"C ABOVE CEILING FROM J-BOX
F	FIRE ALARM OUTDOOR SPEAKER, WEATHER PROOF: STUB 3/4"C ABOVE CEILING FROM J-BOX

ELECTRICAL LEGEND-GENERAL

---ALL SYMBOLS SHOWN MAY NOT APPEAR IN ALL DRAWINGS.
SYMBOLS ARE SHOWN SCHEMATIC AND MAY NOT BE TO SCALE.

SYMBOL	DESCRIPTION
	HEAVY DUTY DISCONNECT SWITCH FUSED
	HEAVY DUTY DISCONNECT SWITCH NONFUSED
	HEAVY DUTY COMBINATION DISCONNECT/MOTOR STARTER
	HEAVY DUTY MOTOR STARTER
	ENCLOSED BREAKER, RE: TO SCH. FOR MORE INFO.
R	ROTARY TYPE DISCONNECT SWITCH
M	120/277-208/480V.20AMP, MOTOR RATED SWITCH, NEMA-1 (INTERIOR) ENCLOSURE, NEMA-3R(EXTERIOR) ENCLOSURE. VOLTAGE TO BE SELECTED PER EQUIPMENT CIRCUIT REQUIREMENTS.
	MOTOR
	PANELBOARD, CLEARANCE AS PER LATEST NEC
	SWITCH LEG
	ELECTRICAL CONDUIT
	UNDERGROUND ELECTRICAL CONDUIT
	COMMUNICATION CONDUIT AND WIRING
X, X, X	MULTI-POLE DEVICE CIRCUIT NUMBERS
X/X/X	THREE SINGLE POLE DEVICE CIRCUIT NUMBERS
A-1	CONDUIT AND WIRE HOMERUN TO PANEL. SHORT HATCH INDICATES NEUTRAL CONDUCTOR, LONG HATCHES INDICATE PHASE CONDUCTORS, AND LONG HATCH WITH CIRCLE INDICATES ISOLATES OR INSULATED GROUND. ALPHANUMERIC DESCRIPTION INDICATES PANEL AND BREAKER.
A-1	UNDERGROUND CONDUIT AND WIRE HOMERUN TO PANEL. SHORT HATCH INDICATES NEUTRAL CONDUCTOR, LONG HATCHES INDICATE PHASE CONDUCTORS, AND LONG HATCH WITH CIRCLE INDICATES ISOLATED OR INSULATED GROUND. ALPHANUMERIC DESCRIPTION INDICATES PANEL AND BREAKER.
# / #	DETAIL NUMBER / SHEET NUMBER
T	THERMOSTAT WALL MOUNTED - STUB 1/2"C ABOVE CEILING FROM OUTLET BOX. COORDINATE EXACT LOCATION AND HEIGHT WITH MECHANCIAL DIVISION.
J	JUNCTION BOX - SIZE & MOUNTING AS REQUIRED MINIMUM OF 4" SQUARE
	PHOTO CELL(MFR.INTERMATIC #K4136M)
	LIGHTING CONTACTOR, NEMA-1, W/H.O.A. SWITCH
	TIME CLOCK (MFR.TORK#72022)
CP-1	CIRCULATING PUMP
	ELECTRICAL DEVICE AS SHOWN ON PLANS SURFACE MOUNT RACEWAY. SURFACE MOUNT RACEWAY SHALL BE WIREMOLD #V700 SERIES. PROVIDE ALL RELATED #V700 SERIES ACCESSORIES FOR AN OPERABLE SYSTEM.

ELECTRICAL ABBREVIATIONS:

ABBV:	DESCRIPTION	ABBV:	DESCRIPTION
AFF	ABOVE FINISHED FLOOR	MFR. (S.C.)	MANUFACTURER SHARE CIRCUIT
BFC	BELOW FINISHED CEILING	QRCPT(S)	QUAD RECEPTACLE(S)
C	CONDUIT	RCPT(S)	DUPLEX RECEPTACLE(S)
CB	CIRCUIT BREAKER	CRCPT(S)	I.G. RECEPTACLE(S)
EC	EMPTY CONDUIT	QCRCPT(S)	QUAD I.G. RECEPTACLE(S)
EX	EXISTING	PNL	PANEL
F	FUSE	SO (S.O.)	SPACE ONLY
G	GROUND (EQUIPMENT)	SP	SPARE
GFI	GROUND FAULT INTERRUPTER	ST (S.T.)	SHUNT TRIP
MTD	MOUNT OR MOUNTED	SW	SWITCH
NF	NONFUSED	UF	UNDERFLOOR
NIC	NOT IN CONTRACT	UG	UNDERGROUND
H.D	HEAVY DUTY	UNO(U.N.O.)	UNLESS NOTED OTHERWISE
NL	NIGHT LIGHT	WG	WIRE GUARD
AC	ABOVE COUNTER	WP	WEATHERPROOF
HT.	HEIGHT	XFMR	TRANSFORMER
MTD.	MOUNTING	MB	MAIN BREAKER
FDR.	FEEDER	MLO	MAIN LUGS ONLY
CKT.	CIRCUIT	RMC	RIGID METAL CONDUIT
LTG.	LIGHTING	RNC	RIGID NONMETALLIC CONDUIT
LC	LIGHTING CONTACTOR	EMT	ELECTRICAL METALLIC TUBING CONDUIT
IG	ISOLATED GROUND	S/N	SOLID NEUTRAL
EA.	EACH	AC	ABOVE COUNTER
N1	NEMA-1	AHJ	AHJ/AUTHORITY HAVING JURISDICTION
N3R	NEMA-3R	T	TAMPER PROOF
N4X	NEMA-4X		
SS	STAINLESS STEEL		

NOTES:

1.) 48" AFF INDICATES TO TOP OF DEVICE;
15" AFF INDICATES TO BOTTOM OF DEVICE;
ALL OTHER MOUNTING HEIGHTS REFER TO CENTERLINE OF DEVICE.
AC INDICATES 6" ABOVE COUNTER TO BOTTOM OF DEVICE.

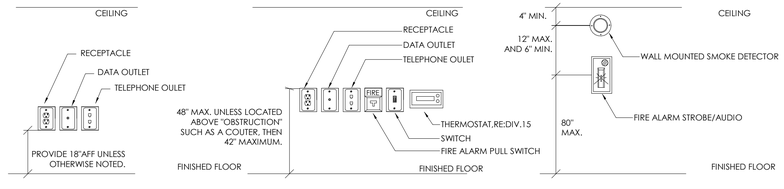
ELECTRICAL LEGEND - WIRING DEVICES

---ALL SYMBOLS SHOWN MAY NOT APPEAR IN ALL DRAWINGS.
SYMBOLS ARE SHOWN SCHEMATIC AND MAY NOT BE TO SCALE.

	SINGLE RECEPTACLE - 20A/125V/2P/3W/G NEMA 5-20R
	DUPLEX RECEPTACLE - 20A/125V/2P/3W/G NEMA 5-20R
T T	DUPLEX RECEPTACLE TAMPER RESISTANT - 20A/125V/2P/3W/G NEMA 5-20R
H H	HOSPITAL GRADE DUPLEX RECEPTACLE/GFI - 20A/125V/2P/3W/G NEMA 5-20R
PR	CEILING MT DUPLEX RECEPTACLE FOR PROJECTOR- 20A/125V/2P/3W/G NEMA 5-20R
	DUPLEX RCPT, GFI - 20A/125V/2P/3W/G NEMA 5-20R
WP/ "IN-USE"	DUPLEX RCPT.,WEATHER RESISTANT "WR", GFI INSTALLED IN A "IN-USE" WEATHER PROOF STEEL ENCLOSURE- 20A/125V/2P/3W/G NEMA 5-20R WP/"IN-USE" SHALL BE EQUAL TO MFR. CARLON; METALLIC SERIES SINGLE GANG, VERTICAL MOUNT #ME9UVMG DOUBLE GANG, VERTICAL MOUNT #ME9U2VMG
	QUADRAPLEX RECEPTACLE
	ISOLATED GROUND QUADPLEX RECEPTACLE
	ISOLATED GROUND DUPLEX RECEPTACLE - 20A/125V NEMA 5-20R
	208V RECEPTACLE, VERIFY NEMA NO. WITH EQUIPMENT SUPPLIER
	SPECIAL PURPOSE RECEPTACLE (NEMA NO. AS INDICATED)
HD	J-BOX - AIR HAND DRYER: (RECESSED HAND DRYERS TO BE PROVIDED BY DIVISION 26, ELECTRICAL) 120V MODEL #SLIMDRI AS MANUFACTURER BY WORLD DRYER. (COLOR WHITE) QUANTITY: REFER TO DRAWINGS (MIN. ONE PER LAV. COMPLETE W/ ELE. CONNECTIONS TYP.)
	4-GANG FLOOR MOUNTED BOX, 2-DUPLEX RECEPTACLE(INCLUDE RECEPTACLE WITH COVER PLATE)/2-GANG FOR DATA - FLUSH MOUNTED UNO FLOOR BOX = MFR.-HUBBELL MODEL#CFB4G30RCR-CFBS1R8CVRNKL(COVER)-(2)FBMPDUP-FBMP6KS -CFB1HUB2(MULTISERVICE STEEL RECESSED FLOOR BOX-VERIFY FLOOR FINISH PRIOR TO ORDER SAME BOX FOR DATA OUTLETS.
6G	6-GANG FLOOR MOUNTED BOX, 3-DUPLEX RECEPTACLE(INCLUDE RECEPTACLE WITH COVER PLATE)/3-GANG FOR DATA - FLUSH MOUNTED UNO FLOOR BOX = MFR.-HUBBELL MODEL#CFB6G30CR-CFBS1R8CVRALU(COVER)-(3)FBMPDUP-FBMP6KS -CFB1HUB2(MULTISERVICE STEEL RECESSED FLOOR BOX-VERIFY FLOOR FINISH PRIOR TO ORDER SAME BOX FOR DATA OUTLETS.
6P	6" FIRE RATED POKE-TRHOUGHS BOX, 2-DUPLEX RECEPTACLE(INCLUDE RECEPTACLE WITH COVER PLATE)- MFR.-HUBBELL MODEL#S1R6PTFIT-S1R6SPE-S1R6SPL-S1R6SPH(50/50 DEVICE PLATE COMBINATION)-S1R6CVRALU(COVER) -VERIFY FLOOR FINISH PRIOR TO ORDER SAME BOX FOR DATA OUTLETS.
6JP	6" FIRE RATED POKE-TRHOUGHS BOX, FURNITURE FEED,- MFR.-HUBBELL MODEL#S1R6PTFFALU(ALUMINUM COVER) -VERIFY FLOOR FINISH PRIOR TO ORDER.
8P	8" FIRE RATED POKE-TRHOUGHS BOX, 2-DUPLEX RECEPTACLE(INCLUDE RECEPTACLE WITH COVER PLATE)- MFR.-HUBBELL MODEL#S1R8PTFIT3-S1R8CSPK-S1R8CSPK-S1R8PSPZ(50/50 DEVICE PLATE COMBINATION)-S1R8CVRALU(COVER) -VERIFY FLOOR FINISH PRIOR TO ORDER SAME BOX FOR DATA OUTLETS.

MOUNTING HEIGHT DETAIL

NOTE: VERIFY WITH ARCHITECTURAL FOR **ADA REQUIREMENTS.**



GENERAL ELECTRICAL NOTES

1. ALL SYMBOLS AND ABBREVIATIONS SHOWN ON THIS LEGEND MAY NOT APPEAR ON THIS SET OF DRAWINGS.
2. USE DIRECTIONAL ARROW ON EXIT SIGNS AS REQUIRED.
3. IEEE STANDARD C37.2-1991, ELECTRICAL POWER SYSTEM DEVICE FUNCTION NUMBERS.
4. CONTRACTOR SHALL NOT INSTALL MORE THAN THREE CURRENT CARRYING CONDUCTORS IN A COMMON RACEWAY. IF CONTRACTOR IS PLANNING ON GROUPING MULTIPLE CIRCUITS IN A SINGLE RACEWAY, THE CONTRCATOR MUST SUBMIT ALL DERATING CALCULATIONS FOR THE PROPOSED INSTALLATION IN ACCORDANCE WITH NEC ARTICLE 310.15 (B) (2) FOR APPROVAL PRIOR TO INSTALLATION. NON APPROVED INSTALLATIONS WILL BE REMOVED AND REINSTALLED BY THE CONTRACTOR IN ACCORDANCE WITH THE NEC AT NO ADDITIONAL COST TO THE OWNER.
5. THERE SHALL NOT BE MORE THAN THE EQUIVALENT OF THREE 90° BENDS (270 DEGREES TOTAL) BETWEEN PULL POINTS. WHERE THERE ARE MORE THAN THREE QUARTER BENDS, CONTRACTOR SHALL PROVIDE PULL BOXES AS SPECIFIED AND SIZED IN ACCORDANCE WITH NEC.
6. COMPLY WITH NEC REQUIREMENTS FOR ELECTRICAL INSTALLATIONS. ALL ELECTRICAL EQUIPMENT AND MATERIAL TO BE APPROVED, LISTED, LABELED, IDENTIFIED AND INSTALLED PER RECOGNIZED ELECTRICAL TESTING LABORATORY.
7. ALL RECEPTACLES, SWITCHES AND JUNCTION BOXES SERVED BY EMERGENCY BRANCH CIRCUITS SHALL BE "RED" IN COLOR. COVERPLATES SHALL BE LABELED IN ACCORDANCE WITH SPECIFICATIONS TO INDICATE PANELBOARD AND CIRCUIT NO. (IE: ET*LA-3).

ELECTRICAL: LIGHTING FUNCTIONAL TESTING / COMMISSIONING PLAN:

CONTRACTOR SHALL PERFORM THE TASK BELOW TO COMMISSION THE LIGHTING CONTROL SYSTEM. CONTRACTOR SHALL SUBMIT A DOCUMENTATION DETAILING THE LIGHTING CONTROL SYSTEM, SETTING/CONDITION, ACTIONS PERFORMED AND FINAL SETTING CONDITION. SUBMIT DOCUMENTATION AT OR BEFORE SUBSTANTIAL COMPLETION TO FACILITATE OBTAINING THE CERTIFICATE OF OCCUPANCY.

A. ENSURE ALL LIGHTING FIXTURES FIXTURES HAVE LAMPS INSTALLED AND ARE FUNCTIONAL.
B. TEST ALL EXIT SIGNS, EMERGENCY LIGHTING FIXTURES, AND EMERGENCY BALLASTS FURNISHED INTEGRAL TO FIXTURES.
C. ENSURE ALL OCCUPANCY SENSORS HAVE BEEN INSTALLED AND ARE OPERATIONAL.
D. VERIFY ALL WALLBOX AND SCENE CONTROLLERS ARE INSTALLED AND OPERATIONAL.
E. TEST EACH INDIVIDUAL DEVICE FOR OCCUPANCY SENSOR TYPES OS1, OS2 AND TEST THE LIGHTING CONTROL RELAY PANEL SYSTEM.
F. TEST 10% OF ALL THE DEVICES FOR OCCUPANCY SENSOR TYPE: WSX-PDT-SA.
G. VERIFY THE FOLLOWING:
1. ALL SENSORS ARE LOCATED AND AIMED PER THE MANUFACTURER'S RECOMMENDATIONS.
2. STATUS INDICATORS ON DEVICES ARE OPERATIONAL AND CORRECT.
3. DEVICES CONTROL LIGHTING FIXTURES AS INDICATED ON DRAWINGS.
4. TIME DELAYS HAVE BEEN SET AS PER CODE AND PER OWNERS DIRECTIONS.
5. MOVEMENT IN ADJACENT AREAS AND/ CYCLING OF HVAC SYSTEMS DOES NOT FALSE TRIGGER SENSORS.
6. PHOTOCELL LOCATION AND AIMED PER MANUFACTURERS RECOMMENDATIONS.
7. PROGRAM INTERIOR RELAYS WITH A TIME FUNCTION ACCEPTABLE TO OWNER.
8. PROGRAM INTERIOR OVERRIDE SWITCH WITH A TIME FUNCTIONAL ACCEPTABLE BY OWNER.

APPLICABLE BUILDING CODE

2018 International Building Code
2018 International Plumbing Electrical Code
2018 International Mechanical Code
2018 International Energy Conservation Code
2018 International Existing Building Code
2017 National Electrical Code of the National Fire Protection Association
2018 International Fire Code
2012 Texas Accessibility Standards

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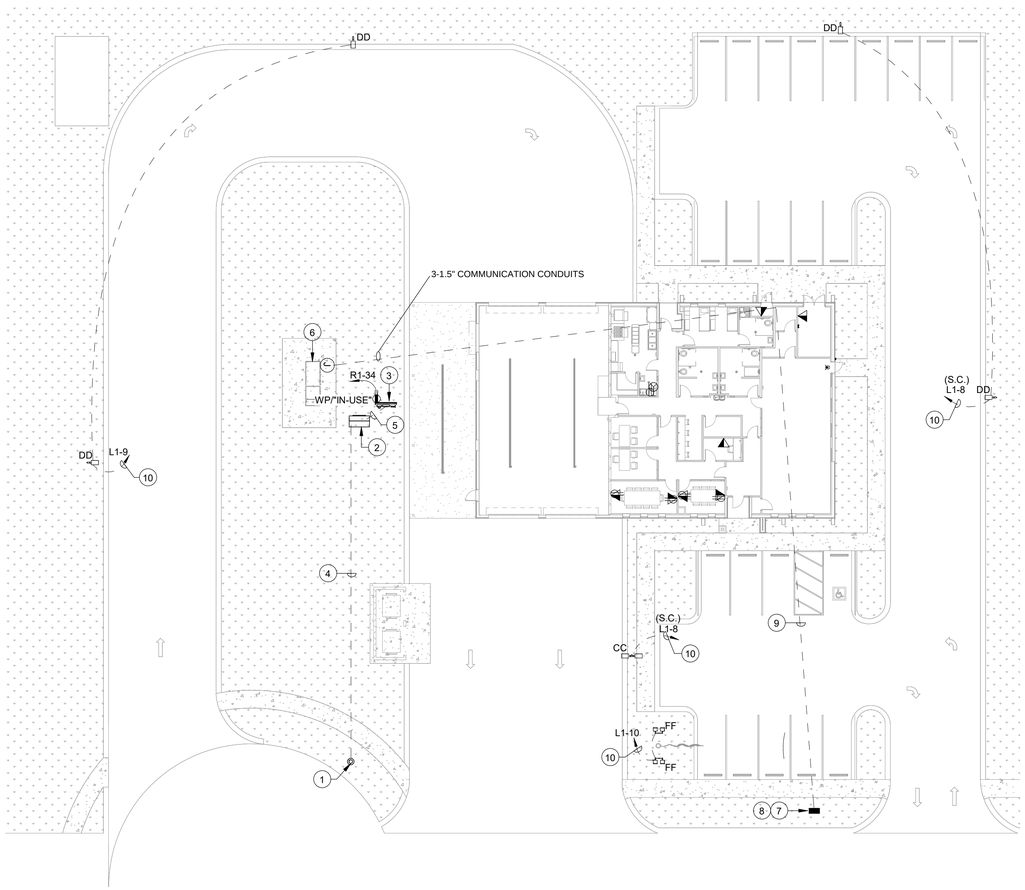

1 ELECTRICAL SITE PLAN
1" = 20'-0"

GENERAL NOTES - ELECTRICAL SITE

A. CONTRACTOR TO VERIFY ALL EXISTING MAIN POWER SERVICES AND COORDINATE WITH POWER COMPANY FOR ALL NEW REQUIREMENTS AND ALL COST ASSOCIATED. CONTRACTOR SHALL INCLUDE ANY COST FOR THE NEW TRANSFORMER AND OTHER ASSOCIATED FEES IN BID. CONTRACTOR IS RESPONSIBLE TO VERIFY ALL FEES WITH POWER COMPANY AND TO INCLUDE IN BID. CONTRACTOR IS RESPONSIBLE TO COORDINATE WITH POWER COMPANY AS SOON THE CONTRACT IS AWARDED TO ORDER TRANSFORMER AND THE RELATED ELECTRICAL SERVICE EQUIPMENT AS SOON AS POSSIBLE.

B. CONTRACTOR IS RESPONSIBLE FOR ALL EXCAVATION, TRENCHING AND BACKFILLING. COORDINATE WITH ALL UTILITIES PRIOR TO EXCAVATION.

C. CONTRACTOR TO VERIFY ALL EXISTING MAIN TELEPHONE SERVICES AND COORDINATE WITH TELEPHONE COMPANY FOR ALL REQUIREMENTS AND ALL COST ASSOCIATED. INCLUDE ALL COST IN BID. CONDUIT FROM MAIN TELEPHONE RISER SHALL BE FURNISHED AND INSTALLED BY ELECTRICAL CONTRACTOR.

D. ALL ELECTRICAL EQUIPMENT OUTDOORS SHALL BE RATED TYPE NEMA 3R UNLESS OTHERWISE NOTED.

E. CONTRACTOR SHALL HAVE A WORKING KNOWLEDGE OF LOCAL CODES AND ORDINANCES. ALL WORK SHALL CONFORM TO NATIONAL ELECTRICAL CODES AND ALL OTHER AUTHORITY HAVING JURISDICTION. OBTAIN PERMITS AND PAY ALL FEES. PERFORM MODIFICATIONS TO MEET CODE AND ORDINANCE REQUIREMENTS AT NO ADDITIONAL COST TO OWNER, ARCHITECT OR ENGINEER. VERIFY PRIOR TO BID DATE.

F. VERIFY AT JOB SITE THE EXACT LOCATIONS OF STRUCTURAL MEMBERS SUCH AS BEAMS, COLUMNS, ETC. TO LOCATE EQUIPMENT CONDUIT, PANELS AND DEVICES. IF DEVIATIONS FROM THE DRAWING ARE NECESSARY TO MEET STRUCTURAL CONDITIONS MAKE DEVIATIONS WITHOUT ADDITIONAL COST, TO OWNER, ARCHITECT, OR ENGINEER.

G. IN COOPERATION WITH OTHER CONTRACTORS, DETERMINE THE EXACT LOCATION OF EQUIPMENT AND DEVICES AND CONNECTIONS THERETO BY REFERENCE TO THE SUBMITTALS AND ROUGH-IN DRAWINGS, AND BY MEASUREMENTS AT THE SITE. REFER TO ALL OTHER TRADES SUBMITTAL FOR ELECTRICAL INFORMATION.

H. GROUND ENTIRE ELECTRICAL SYSTEM IN STRICT ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE.

I. VERIFY AT JOB SITE GENERAL WORK TO BE DONE AS SPECIFIED, AS NOTED, OR AS REQUIRED FOR INSTALLATION ELECTRICAL SYSTEMS PRIOR TO SUBMISSION OF BIDS.

J. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS AND EQUIPMENT TO BE REMOVED AND REPLACED BEFORE SUBMITTING HIS BID.

K. ELECTRICAL DRAWINGS ARE DIAGRAMMATIC AND SMALL SCALE ONLY. THEY CONVEY THE INTENT OF THE WORK BUT DO NOT SHOW DETAIL SUCH AS JUNCTION AND PULL BOXES REQUIRED BY THE SPECIFICATIONS AND THE NATIONAL ELECTRICAL CODE(NEC). PROVIDE ALL MATERIALS AND METHODS CALLED FOR IN THE SPECIFICATIONS AND AS REQUIRED IN THE NEC TO PROVIDE A COMPLETE INSTALLATION OF ALL WORK.

L. ALL WIRING SHALL BE COPPER.

M. ALL SLEEVES, PENETRATIONS, ETC. SHALL BE SEALED SOLID NON-SHRINKING MATERIAL IMMEDIATELY UPON FILLING OF THE OPENING WITH PIPE OR CONDUIT.

N. ARRANGE FOR SOURCES OF TEMPORARY CONSTRUCTION SERVICES. SUCH SERVICES SHALL BE NOMINALLY 120/240V, 1-PHASE, 3-WIRE FROM WHICH A COMPLETE SYSTEM OF TEMPORARY POWER AND LIGHTING SHALL BE PROVIDED FOR ALL CONSTRUCTION NEEDS.

ELECTRICAL KEYNOTES

1	NEW POWER COMPANY POWER POLE WITH RISER DIP POLE.
2	NEW POWER COMPANY ELECTRICAL TRANSFORMER. COORDINATE EXACT LOCATION AND ALL ELECTRICAL REUQIRMENTS WITH POWER COMPANY PRIRO TO COMMENCING ANY WORK.
3	NEW 120/208V, 3-PHASE, 4W, ELECTRICAL SERVICE EQUIPMENT.
4	CONTRACTOR TO PROVIDE AND INSTALL (1)-4" PVC CONDUIT FROM PROPOSED NEW UTILITY COMPANY POWER POLE WITH RISER DIP POLE TO NEW PAD MOUNT TRANSFORMER. ALL UNDERGROUND WORK SHALL BE ACCORDING TO POWER COMPANY STANDARDS. VERIFY ALL REQUIREMENTS WITH THE POWER COMPANY BEFORE ANY ROUGH-IN. COORDINATE LOCATION, COST, AND INSTALLATION WITH POWER COMPANY PRIOR TO BID.
5	CONTRACTOR TO PROVIDE AND INSTALL PVC CONDUIT FROM NEW UTILITY TRANSFORMER TO NEW ELECTRICAL SERVICE EQUIPMENT PER POWER COMPANY STANDARDS. VERIFY ALL REQUIREMENTS PRIOR TO ANY ROUGH-IN. REFER TO ELECTRICAL RISER DIAGRAM.
6	PROPOSED GENERATOR LOCATION.
7	NEW TELEPHONE PEDESTAL. VERIFY ALL REQUIREMENTS PRIOR TO ANY ROUGH-INS.
8	TIE INTO EXISTING MAIN TELEPHONE LINE. COORDINATE WITH THE TELEPHONE COMPANY PRIOR TO ANY ROUGH-INS.
9	CONTRACTOR TO PROVIDE AND INSTALL (2)-4"PVC CONDUIT FOR TELEPHONE SERVICE EQUIPPED WITH PULLSTRING, AND TURNED UP AND CAPPED AT BOTH ENDS. DEPTH OF CONDUIT SHALL BE A MINIMUM OF 36". VERIFY ALL REQUIREMENTS WITH LOCAL UTILITIES BEFORE ROUGH-IN. ROUTE TO THE NEAREST TELEPHONE SERVICE LINE OR AS DIRECTED BY LOCAL TELEPHONE COMPANY. PROVIDE TRENCHING AND BACKFILL AS REQUIRED. COORDINATE EXACT LOCATION AND COST WITH TELEPHONE COMPANY PRIOR TO BID.
10	SHALL BE CONTROLLED VIA LIGHTING CONTROL PANEL 'LCP1'. PROGRAM WITH TIME FUNCTIONS PER OWNER DIRECTIONS.

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GENERAL NOTES- LIGHTING

A. ALL EXIT FIXTURES/EMERGENCY BATTERY PACK LIGHT FIXTURE SHALL BE CONNECTED TO UNSWITCHED OR NON-DIMMING HOT LEG OF SAME VOLTAGE/PHASE OF LOCAL LIGHTING CIRCUIT IN SPACE.
A.ALL EXIT FIXTURES/EMERGENCY BATTERY PACK LIGHT FIXTURE SHALL BE CONNECTED TO UNSWITCHED OR NON-DIMMING HOT LEG OF SAME VOLTAGE/PHASE OF LOCAL LIGHTING CIRCUIT IN SPACE.

B. VERIFY CEILING TYPES AND COORDINATE WITH FIXTURE TYPE LIGHT FIXTURE SHALL BE COMPATIBLE WITH CEILING TYPE AS INDICATED ON THE ARCHITECTURAL DOCUMENTS. NOTIFY ENGINEER IF DISCREPANCIES EXIST PRIOR TO ORDERING FIXTURES.

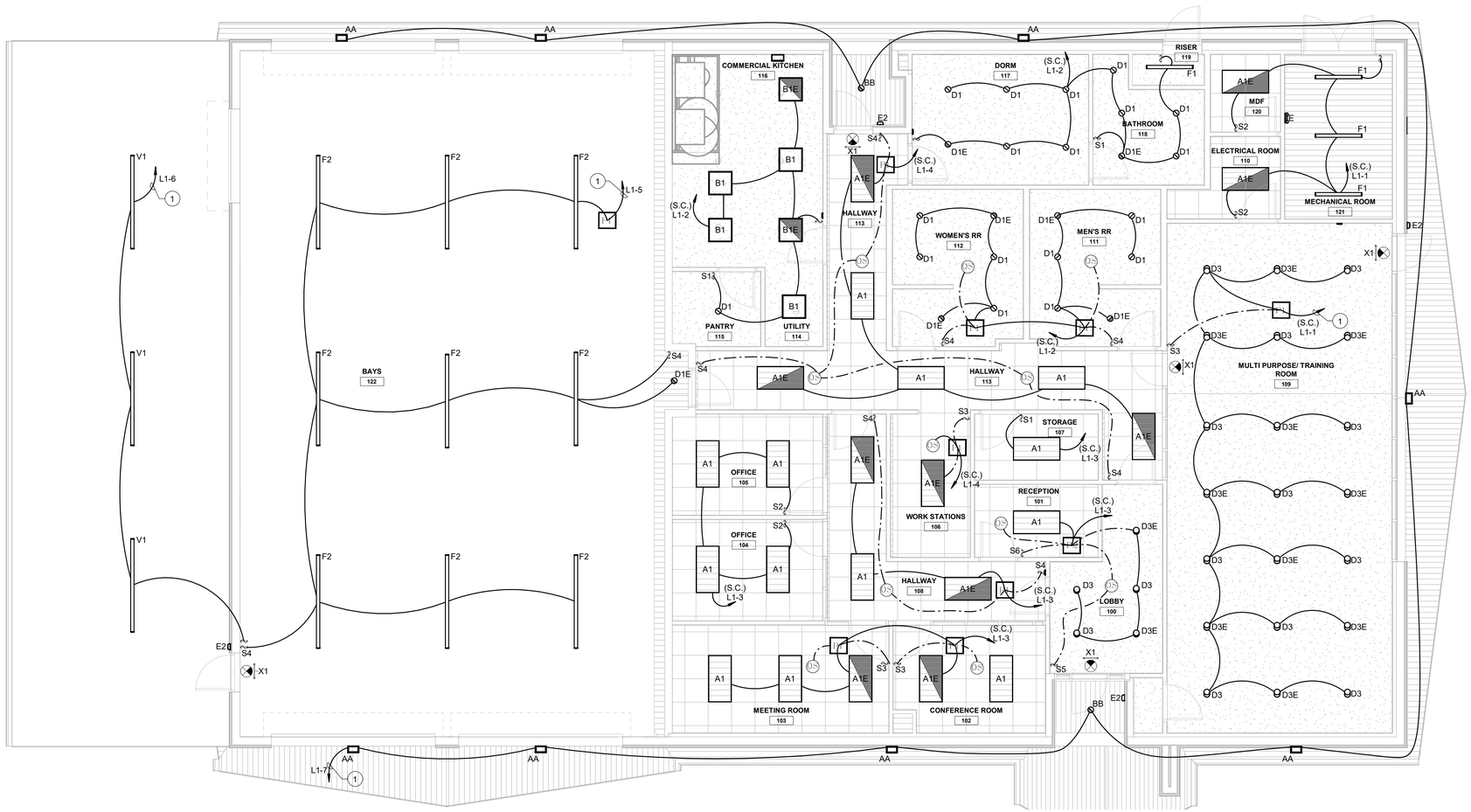
C. COORDINATE EXACT ROUTING OF ALL CONDUIT ABOVE CEILING IN BUILDING. TYPICAL FOR ALL BUILDING EXTERIOR LIGHTING.

D. COORDINATE LOCATION OF LIGHTS WITH DIFFUSERS AND GRILLES.

E. SWITCH LEGS ARE NOT SHOWN WHERE SWITCHING SCHEME IS OBVIOUS.

F. ALL EXIT FIXTURES TYPE-"X1 & X2", EMERGENCY LIGHT FIXTURE TYPE-"E" AND ALL EMERGENCY BALLAST SHALL BE ON CIRCUIT "DPEL-38". FIXTURE TYPE LABEL WITH AN "_E" ARE LIGHT FIXTURES WITH EMERGENCY BALLAST. REFER TO LIGHT FIXTURE SCHEDULE.

ELECTRICAL KEYNOTES	
1	SHALL BE CONTROLLED VIA LIGHTING CONTROL PANEL 'LCP1'. PROGRAM WITH TIME FUNCTIONS PER OWNER DIRECTIONS.



1 ELECTRICAL LIGHTING PLAN - FIRST FLOOR
3/16" = 1'-0"

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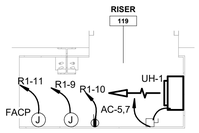
GENERAL NOTES- POWER

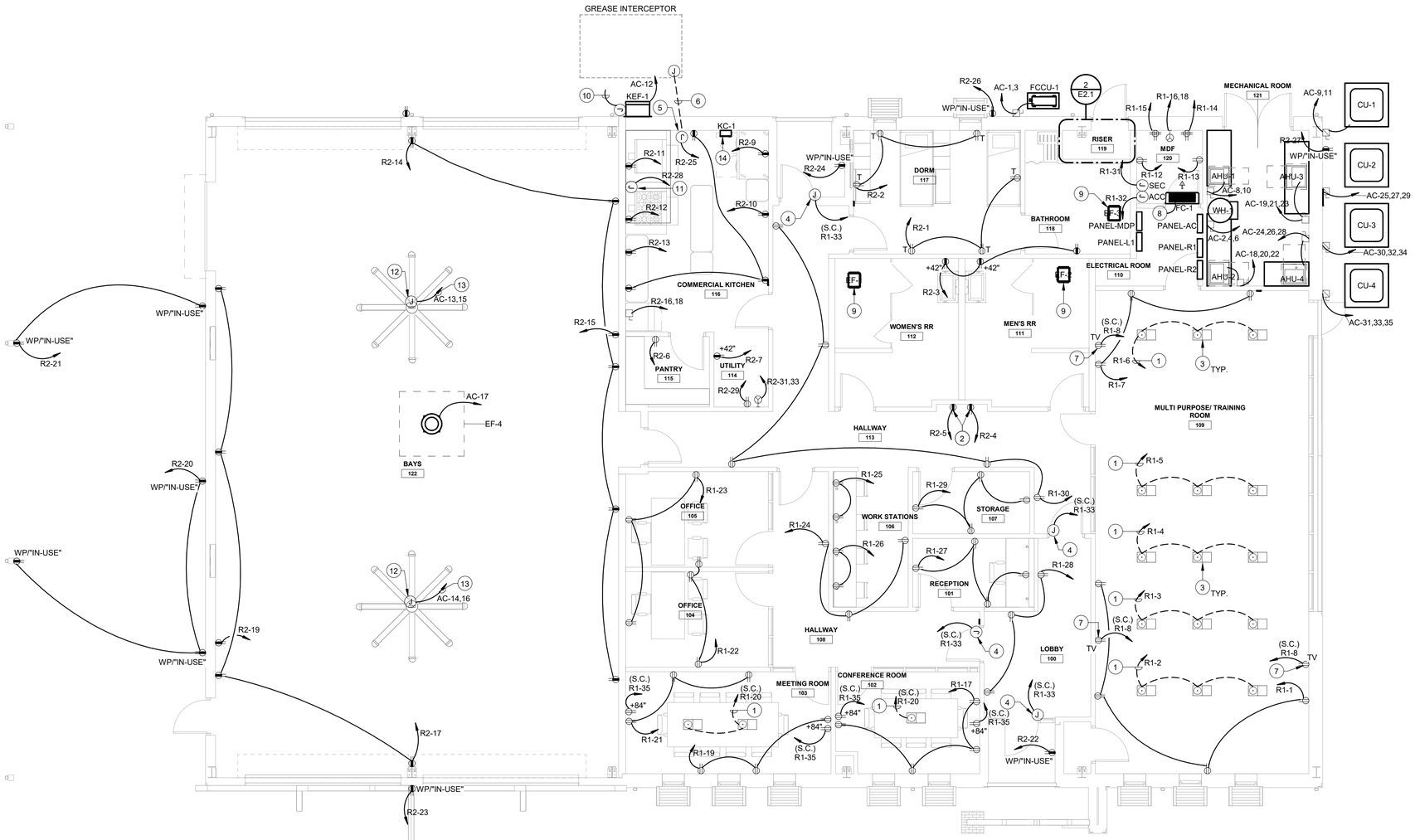
A. COORDINATE EXACT LOCATION AND MOUNTING HEIGHT OF ALL POWER SOURCE WIRING IN ACCORDANCE WITH ARCHITECTURAL MILLWORK.
B. ELECTRICAL CONTRACTOR SHALL MAKE FINAL CONNECTION TO H.V.A.C EQUIPMENT, PLUMBING EQUIPMENT, REFER TO PANEL SCHEDULE FOR WIRE SIZE.
C. ELECTRICAL CONTRACTOR SHALL PROVIDE STARTERS, RELAYS, CONTACTORS AND THE REQUIRED ELECTRICAL ACCESSORIES FOR MECHANICAL SYSTEM AS REQUIRED.
D. COORDINATE EXACT LOCATION OF ALL MECHANICAL EQUIPMENT IN ACCORDANCE W/MECHANICAL DRAWINGS TO MEET ELECTRICAL AND MECHANICAL REQUIRED CLEARANCE BY THE LATEST CODE.
E. COORDINATE EXACT LOCATION OF ISOLATED OUTLETS FOR COMPUTERS WITH OWNER.
F. ELECTRICAL CONTRACTOR SHALL PROVIDE J-BOX AND CONDUIT FOR H.V.A.C. CONTROLS AND THERMOSTATS. COORDINATE EXACT LOCATION WITH MECHANICAL CONTRACTOR.
G. NEMA RATED OUTLETS, REFER TO BREAKER SIZE AND COORDINATE WITH EQUIPMENT REQUIREMENTS PRIOR TO BID.

ELECTRICAL KEYNOTES

1	ROUTE THROUGH NEAREST FULL WALL. ALL CONDUIT MUST BE CONCEALED. COORDINATE WITH CONTRACTOR PRIOR TO COMMENCING ANY WORK.
2	COORDINATE EXACT LOCATION WITH PLUMBER TO CONCEAL CORD BEHIND ELECTRIC DRINKING FOUNTAIN PRIOR TO ANY ROUGH-IN.
3	COORDINATE EXACT LOCATION OF FLOOR BOX WITH OWNER/ARCHITECT PRIOR TO ANY WORK.
4	J-BOX FOR DOOR ACCESS CONTROLS. COORDINATE EXACT LOCATION AND ELECTRICAL REQUIREMENTS WITH OWNER AND EQUIPMENT SUPPLIER PRIOR TO COMMENCING ANY WORK.
5	GREASE TRAP SERVICE ALERT PANEL. COORDINATE EXACT LOCATION PRIOR TO ANY WORK.
6	PROVIDE 1"C WITH PULLSTRING FOR GREASE TRAP SENSOR. COORDINATE EXACT LOCATION OF STUB UPS PRIOR TO ANY WORK.
7	COORDINATE EXACT MOUNTING HEIGHT AND LOCATION OF TV RECEPTACLES WITH OWNER/ARCHITECT PRIOR TO ANY WORK.
8	INTERLOCK FCCU WITH FC H.V.A.C. EQUIPMENT. WIRING SHALL BE 3#10, 1#10G, 3/4"C.
9	TIE INTO ROOMS LIGHTING CIRCUIT AND INTERLOCK FAN WITH ROOMS LIGHTS. WIRING SHALL BE 2#12, 1#12G, 1/2"C.
10	1-1.5"C WITH PULLSTRING, ROUTE TO KITCHEN KITCHEN VENTILATION CONTROL PANEL SYSTEM. COORDINATE WITH EQUIPMENT SUPPLIER AND MECHANICAL DOCUMENTS PRIOR TO COMMENCING ANY WORK. REFER TO MECHANICAL DOCUMENTS FOR WIRING DIAGRAMS AND DETAILS.
11	PROVIDE J-BOX FOR RANGE HOOD FIRE SUPPRESSION SYSTEM. COORDINATE EXACT LOCATION AND ELECTRICAL REQUIREMENTS WITH CONTRACTOR PRIOR TO ANY WORK.
12	J-BOX FOR HVLS FAN. COORDINATE ALL ELECTRICAL CONNECTIONS WITH MANUFACTURER AND MECHANICAL CONTRACTOR PRIOR TO COMMENCING ANY WORK.
13	INTERLOCK HVLS FANS WITH FIRE ALARM SYSTEM. COORDINATE ALL WORK WITH EQUIPMENT MANUFACTURE AND FIRE ALARM CONTRACTOR.
14	KITCHEN VENTILATION CONTROL PANEL SYSTEM 'KC-1'. KC-1 TO CONTROL LIGHTS, EXHAUST FANS & MAKEUP AIR UNIT. REFER TO MANUFACTURERS INSTALLATION DOCUMENTS & COORDINATE W/ MECHANICAL DOCUMENTS & CONTRACTOR.



2 RISER ROOM ENLARGEMENT
3/8" = 1'-0"



1 ELECTRICAL POWER FLOOR PLAN - FIRST FLOOR
3/16" = 1'-0"

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GENERAL NOTES:

A. PROVIDE GROUND /BONDING AS INDICATED ON THE NATIONAL ELECTRICAL CODE.

B. NAME PLATES SHALL BE PROVIDED FOR ALL ELECTRICAL SWITCH GEAR, PANEL BOARDS, LIGHTING CONTACTORS, LIGHTING CONTROL PANELS, ETC.. BY ELECTRICAL CONTRACTOR.

C. NEW ELECTRICAL METERING AND SERVICE EQUIPMENT SHALL BE PROVIDED AND INSTALLED ACCORDING TO THE LOCAL POWER UTILITY CO. AND CITY REQUIREMENTS. VERIFY AND COORDINATE WITH POWER UTILITY CO. AND AHJ BEFORE BID AND INSTALLATION.

D. COMPLY WITH NFPA 70E SAFETY REQUIREMENTS.

E. PANELBOARDS WITH MORE THAN 42 CIRCUITS SHALL BE IN ONE CABINET ENCLOSURE, UNLESS OTHERWISE NOTED.

F. PROVIDE 4"CONCRETE PAD FOR ALL DRY-TYPE TRANSFORMERS.

G. ALL TWO SECTION PANELBOARDS SHALL BE FEED THRU LUGS.

H. CONTRACTOR SHALL BE RESPONSIBLE FOR DELIVERY OF ELECTRICAL SERVICE TO THE NEW BUILDING WITHIN PROJECT SCHEDULE. COORDINATE ALL COST FOR LABOR AND MATERIALS WITH LOCAL ELECTRICAL UTILITY COMPANY PRIOR TO BID. ALL COST ASSOCIATED WITH THE DELIVERY OF ELECTRICAL SERVICE INCLUDING ALL MATERIALS SHALL BE INCLUDED IN BID. TRANSITION OF NEW ELECTRICAL SERVICE SHALL PROCEED IN WEEKENDS OR HOLIDAYS. INCLUDE ALL COST IN BID FOR OVERTIME FROM ELECTRIC UTILITY COMPANY. NO ADDITIONAL PAYMENT WILL BE MADE FOR SERVICE DELIVERY COSTS AFTER CONTRACT HAS BEEN AWARDED.

I. CONTRACTOR SHALL INCLUDE ALL COST TO PROVIDE SHORT CIRCUIT AND PROTECTIVE DEVICE. THE SHORT-CURCUIT AND PROTECTIVE DEVICE COORDINATE STUDIES SHALL BE SUBMITTED TO THE DESIGN ENGINEER PRIOR TO RECEIVING FINAL APPROVAL OF THE DISTRIBUTION EQUIPMENT SHOP DRAWINGS AND/OR PRIOR TO RELEASE OF EQUIPMENT DRAWINGS FOR MANUFACTURING. APPROVAL FROM THE ENGINEER MAY BE OBTAINED FOR PRELIMINARILY SUBMITTAL OF SUFFICIENT STUDY DATA TO ENSURE THAT THE SELECTION OF DEVICE AND CHARACTERISTICS WILL BE SATISFACTORY.

J. ELECTRICAL SERVICE 120V THRU 480V 1000AMPS OR MORE SHALL INCLUDE AN ARC REDUCTION MAINTENANCE SWITCH. COORDINATE EXACT LOCATION OF SUCH SWITCH.

K. PROVIDE TRENCHING AND BACKFILLING FOR ALL UNDERGROUND CONDUITS FOR REGULAR NON-ASPHALT/CONCRETE SURFACE.

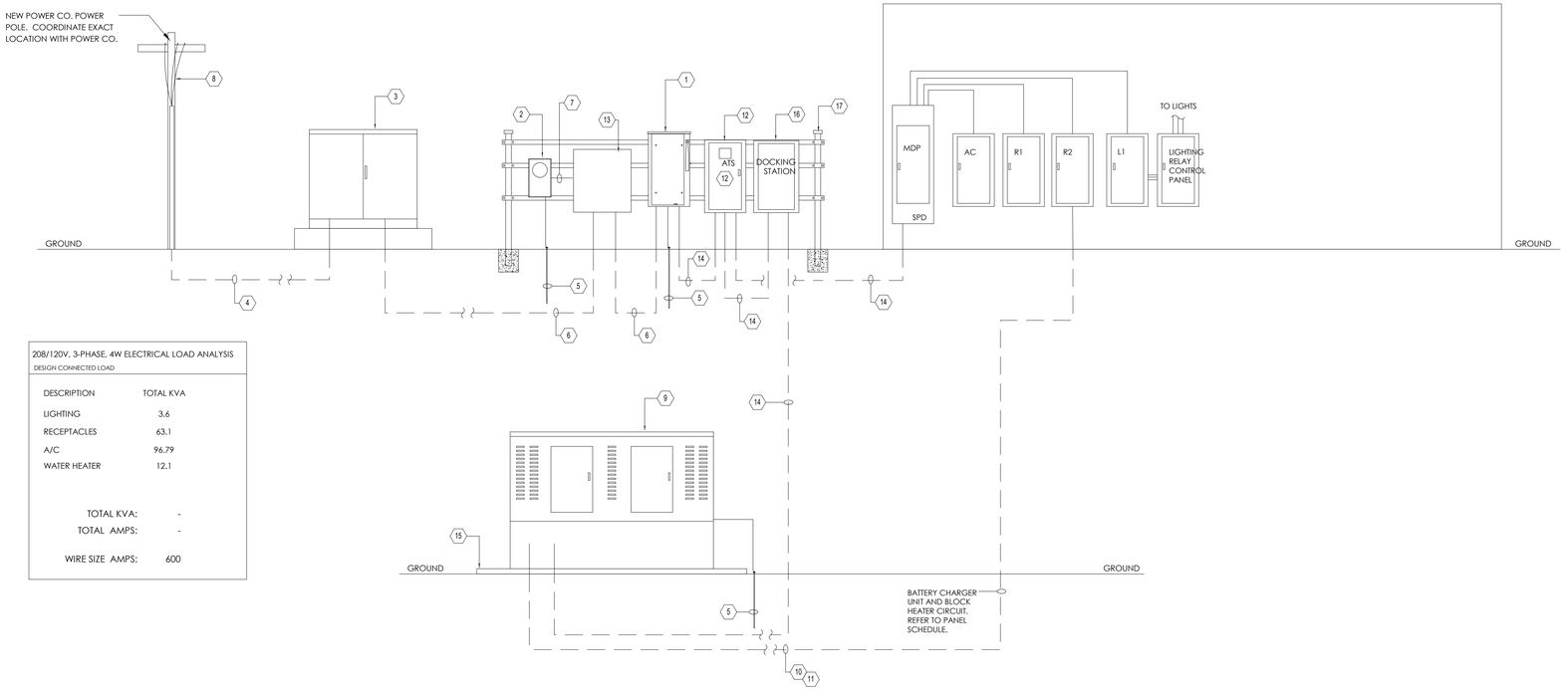
L. PROVIDE SAWCUT AND PATCHING FOR ALL UNDERGROUND CONDUITS FOR REGULAR ASPHALT OR CONCRETE SURFACE. INCLUDE ALL COST TO PATCH SURFACE TO MATCH EXISTING FINISH.

M. THE CONTRACTOR SHALL FURNISH SHORT-CIRCUIT AND PROTECTION DEVICE COORDINATE STUDIES WHICH SHALL BE PREPARED BY THE EQUIPMENT GEAR MANUFACTURER.

N. THE CONTRACTOR SHALL FURNISH AN ARC FLASH HAZARD ANALYSIS STUDY PER NFPA 70E-STANDARD FOR ELECTRICAL SAFETY IN THE WORKPLACE. REFERENCE ARTICLE 130.3 AND ANEEX D.

ELECTRICAL RISER DIAGRAM KEYED NOTES:

1. PROVIDE 600 AMPS, 208V, 3-PHASE, 4W, S/N, N3R, ENCLOSED 100% RATED SOLID STATE, BREAKER WITH ARC ENERGY REDUCTION SWITCH.
2. NEW ELECTRICAL SERVICE METER 208/120V, 3-PHASE, 4W. CONTRACTOR SHALL PROVIDE METER BASE. VERIFY WITH POWER FOR METER BASE REQUIREMENTS PRIOR TO BID DATE. INCLUDE ALL COST IN BID. COORDINATE ALLOCATION OF METER SOCKET AND WIRING WITH POWER COMPANY.
3. NEW POWER COMPANY PAD MOUNT TRANSFORMER 208/120V, 3-PHASE, 4W, PROVIDE CONCRETE PAD AS PER POWER COMPANY REQUIREMENTS.
4. FURNISH AND INSTALL 1-4"C FOR UTILITY PRIMARY RACEWAY TO POWER SOURCE AS DIRECTED BY UTILITY COMPANY. PROVIDE WARNING RIBBONS 12" ABOVE CONDUIT.
5. 1#3/0G IN 1"C, 3/4"X10' COPPER CLAD RODS. PROVIDE GROUNDING AS PER NEC REQUIREMENTS.
6. PROVIDE 2-RUNS EACH OF 4#350KCMIL, 4"C.
7. PROVIDE 1-2"C WITH PULLSTRING.
8. NEW POWER COMPANY POLE WITH RISER DIP POLE. COORDINATE WITH POWER COMPANY FOR ALL REQUIREMENTS.
9. 200KW , 208/120V, 3-PHASE, 4W, 1-600AMP 3-POLE MAIN BREAKER SOLID STATE 100% RATED, U.L. LISTED DIESEL GENERATOR IN A WEATHER PROOF SOUND ATTENUATED ENCLOSURE. PROVIDE CONCRETE PAD. REFER TO SPECIFICATIONS.
10. PROVIDE 1-1.5"C WITH PULLSTRING FOR REMOTE ANUNNCIATOR, COORDINATE EXACT LOCATION- FOR REMOTE ANUNNCIATOR WITH OWNER PRIOR TO ANY ROUGH-INS. LOCATE REMOTE ANUNNCIATOR IN ADMIN. LOBBY #126.
11. 1-1"C TO PANEL FOR BLOCK HEATER CKT, 1-1"C TO PANEL FOR BATTERY CHARGER CKT AND (1)-1"C TO ATS FOR START CONTROLS. START CONTROL WIRING SHALL BE 3#14. VERIFY WITH EQUIPMENT SUPPLIER FOR START WIRING. REFER TO PANEL SCHEDULES FOR BLOCK HEATER AND BATTERY CHARGER CIRCUITS.
12. 600AMP , 208/120V, 3-PHASE, 4W, , S/N, N3R, STAINLESS STEEL, AUTOMATIC TRANSFER DOCKING STATION SWITCH. REFER TO SPECIFICATIONS.
13. PROVIDE NEMA-3R ENCLOSURE FOR UTILITY POWER COMPANY CTS. COORDINATE WITH UTILITY POWER COMPANY FOR REQUIREMENTS PRIOR TO BID DATE.
14. PROVIDE 2-RUNS EACH OF 4#350KCMIL, 1#1G, 4"C.
15. GENERATOR CONCRETE PAD IS A DELEGATED DESIGN. DESIGN TO BE PROVIDED DURING SUBMITTAL PHASE.
16. 600AMP , 208/120V, 3-PHASE, 4W, UL LISTED, DOCKING STATION IN A NEMA-3R ENCLOSURE WITH CAM LOCKS.
17. 3"GALVANIZED PIPE WITH UNISTRUT STAND FOR ELECTRICAL SERVICE EQUIPMENT. COORDINATE WITH UTILITY COMPANY PRIOR TO ANY WORK.



208/120V, 3-PHASE, 4W ELECTRICAL LOAD ANALYSIS
DESIGN CONNECTED LOAD

DESCRIPTION	TOTAL KVA
LIGHTING	3.6
RECEPTACLES	63.1
A/C	96.79
WATER HEATER	12.1
TOTAL KVA:	-
TOTAL AMPS:	-
WIRE SIZE AMPS:	600

1 ELECTRICAL SCHEMATIC DIAGRAM
SCALE: NTS

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Branch Panel: PANEL-MDP

Location: ELECTRICAL ROOM 110 | **Volts:** 120/208 Wye | **A.I.C. Rating:** 35
Supply From: | **Phases:** 3 | **Mains Type:** MB
Mounting: Surface | **Wires:** 4 | **Mains Rating:** 600 A
Enclosure: Type 1 | **MCB Rating:** 600 A

CKT	Load Name	Trip	Poles	Comments	A		B		C		Comments	Poles	Trip	Load Name	CKT
MDP-1	PANEL-L1	100 A	3	##3, 1#6G,1.5"C	1924 VA	7400 VA					##3, 1#6G,1.5"C	3	100 A	PANEL-R1	**MDP-2**
MDP-3	--	--	--	--			2715 VA	12020 VA			--	--	--	--	**MDP-4**
MDP-5	--	--	--	--					10 VA	12840 VA	--	--	--	--	**MDP-6**
MDP-7	PANEL-R2	100 A	3	##3, 1#6G,1.5"C	7076 VA	32936 VA					4#600kcmil, 1#3G,4"C	3	400 A	PANEL-AC	**MDP-8**
MDP-9	--	--	--	--			12776 VA	25736 VA			--	--	--	--	**MDP-10**
MDP-11	--	--	--	--					9680 VA	27713 VA	--	--	--	--	**MDP-12**
MDP-13	Space	--	1		--	--						1	--	Space	**MDP-14**
MDP-15	Space	--	1				--	--				1	--	Space	**MDP-16**
MDP-17	Space	--	1						--	--		1	--	Space	**MDP-18**
MDP-19	Space	--	1		--	--						1	--	Space	**MDP-20**
MDP-21	Space	--	1				--	--				1	--	Space	**MDP-22**
MDP-23	Space	--	1						--	--		1	--	Space	**MDP-24**
MDP-25	Space	--	1		--	--						1	--	Space	**MDP-26**
MDP-27	Space	--	1				--	--				1	--	Space	**MDP-28**
MDP-29	Space	--	1						--	--		1	--	Space	**MDP-30**
MDP-31	Space	--	1		--	0 VA						1	20 A	Spare	**MDP-32**
MDP-33	Space	--	1				--	0 VA				1	20 A	Spare	**MDP-34**
MDP-35	Space	--	1						--	0 VA		1	20 A	Spare	**MDP-36**
MDP-37	1.)SPD	30 A	3	4#8, 1#10G,3/4"C	0 VA	0 VA						1	20 A	Spare	**MDP-38**
MDP-39	--	--	--	--			0 VA	0 VA				1	20 A	Spare	**MDP-40**
MDP-41	--	--	--	--					0 VA	0 VA		1	20 A	Spare	**MDP-42**
		Total Load:			49312 VA		53246 VA		50243 VA						
		Total Amps:			411 A		445 A		420 A						

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Equipment	29472 VA	100.00%	29472 VA		
HVAC	59885 VA	100.00%	59885 VA	**Total Conn. Load:**	152801 VA
Other	1000 VA	100.00%	1000 VA	**Total Est. Demand:**	143841 VA
Receptacle	27920 VA	67.91%	18960 VA	**Total Conn.:**	424 A
Power	30900 VA	100.00%	30900 VA	**Total Est. Demand:**	399 A
Lighting	3641 VA	100.00%	3641 VA		

Notes:
1) PROVIDE INTEGRAL SURGE PROTECTION DEVICE (SPD). 120KVA WITH ITS OWN DISCONNECT MEANS.

Branch Panel: PANEL-AC

Location: ELECTRICAL ROOM 110 | **Volts:** 120/208 Wye | **A.I.C. Rating:** 22
Supply From: PANEL-MDP | **Phases:** 3 | **Mains Type:** MLO
Mounting: Surface | **Wires:** 4 | **Mains Rating:** 400 A
Enclosure: Type 1 | **MCB Rating:** 400 A

CKT	Load Name	Trip	Poles	Comments	A		B		C		Comments	Poles	Trip	Load Name	CKT
AC-1	FCCU-1	20 A	2	3#12, 1#12G,1/2"C	1560 VA	4033 VA					4#6, 1#10G,1"C	3	45 A	WH-1	**AC-2**
AC-3	--	--	--	--			1560 VA	4033 VA			--	--	--	--	**AC-4**
AC-5	UH-1	20 A	2	3#10, 1#10G,3/4"C					7200 VA	4033 VA	--	--	--	--	**AC-6**
AC-7	--	--	--	--	7200 VA	4129 VA					3#8, 1#10G,3/4"C	2	40 A	AHU-1	**AC-8**
AC-9	CU-1	60 A	2	3#12, 1#12G,1/2"C			0 VA	4129 VA			--	--	--	--	**AC-10**
AC-11	--	--	--	--					0 VA	0 VA	2#12, 1#12G,1/2"C	1	20 A	KEF-1	**AC-12**
AC-13	HVLS	20 A	2	3#12, 1#12G,1/2"C	717 VA	717 VA					3#12, 1#12G,1/2"C	2	20 A	HVLS	**AC-14**
AC-15	--	--	--	--			717 VA	717 VA			--	--	--	--	**AC-16**
AC-17	EF-4	30 A	1	2#6, 1#10G,1"C					1900 VA	4860 VA	4#4, 1#6G,1.5"C	3	45 A	AHU-2	**AC-18**
AC-19	AHU-3	45 A	3	4#4, 1#8G,1.5"C	4860 VA	4860 VA					--	--	--	--	**AC-20**
AC-21	--	--	--	--			4860 VA	4860 VA			--	--	--	--	**AC-22**
AC-23	--	--	--	--					4860 VA	4860 VA	4#4, 1#8G,1.5"C	3	45 A	AHU-4	**AC-24**
AC-25	CU-2	60 A	3	4#8, 1#10G,3/4"C	0 VA	4860 VA					--	--	--	--	**AC-26**
AC-27	--	--	--	--			0 VA	4860 VA			--	--	--	--	**AC-28**
AC-29	--	--	--	--					0 VA	0 VA	4#8, 1#10G,3/4"C	3	60 A	CU-3	**AC-30**
AC-31	CU-4	60 A	3	4#8, 1#10G,3/4"C	0 VA	0 VA					--	--	--	--	**AC-32**
AC-33	--	--	--	--			0 VA	0 VA			--	--	--	--	**AC-34**
AC-35	--	--	--	--					0 VA	--		1	--	Space	**AC-36**
AC-37	Spare	20 A	1		0 VA	0 VA						1	20 A	Spare	**AC-38**
AC-39	Spare	20 A	1				0 VA	0 VA				1	20 A	Spare	**AC-40**
AC-41	Spare	20 A	1						0 VA	0 VA		1	20 A	Spare	**AC-42**
		Total Load:			32936 VA		25736 VA		27713 VA						
		Total Amps:			277 A		214 A		233 A						

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Equipment	14400 VA	100.00%	14400 VA		
HVAC	59885 VA	100.00%	59885 VA	**Total Conn. Load:**	86385 VA
Power	12100 VA	100.00%	12100 VA	**Total Est. Demand:**	86385 VA
				Total Conn.:	240 A
				Total Est. Demand:	240 A

Notes:

Branch Panel: PANEL-L1

Location: ELECTRICAL ROOM 110 | **Volts:** 120/208 Wye | **A.I.C. Rating:** 18
Supply From: PANEL-MDP | **Phases:** 3 | **Mains Type:** MLO
Mounting: Surface | **Wires:** 4 | **Mains Rating:** 100 A
Enclosure: Type 1 | **MCB Rating:** 100 A

CKT	Load Name	Trip	Poles	Comments	A		B		C		Comments	Poles	Trip	Load Name	CKT
L1-1	Lighting - Dwelling Unit	20 A	1	2#12, 1#12G,1/2"C	865 VA	543 VA					2#12, 1#12G,1/2"C	1	20 A	Lighting	**L1-2**
L1-3	Lighting	20 A	1	2#10, 1#10G,3/4"C			1012 VA	434 VA			2#12, 1#12G,1/2"C	1	20 A	Lighting	**L1-4**
L1-5	Lighting	20 A	1	2#12, 1#12G,1/2"C					10 VA	0 VA	2#12, 1#12G,1/2"C	1	20 A	Lighting	**L1-6**
L1-7	Lighting	20 A	1	2#12, 1#12G,1/2"C	120 VA	405 VA					2#12, 1#12G,1/2"C	1	20 A	Site Lighting	**L1-8**
L1-9	Site Lighting	20 A	1	2#12, 1#12G,1/2"C			270 VA	1000 VA			2#8, 1#10G,3/4"C	1	20 A	Site Lighting	**L1-10**
L1-11	Space	--	1						--	--		1	--	Space	**L1-12**
L1-13	Space	--	1		--	--						1	--	Space	**L1-14**
L1-15	Space	--	1				--	--				1	--	Space	**L1-16**
L1-17	Space	--	1						--	--		1	--	Space	**L1-18**
L1-19	Space	--	1		--	--						1	--	Space	**L1-20**
L1-21	Space	--	1				--	--				1	--	Space	**L1-22**
L1-23	Space	--	1						--	--		1	--	Space	**L1-24**
L1-25	Space	--	1		--	--						1	--	Space	**L1-26**
L1-27	Space	--	1				--	--				1	--	Space	**L1-28**
L1-29	Space	--	1						--	--		1	--	Space	**L1-30**
L1-31	Space	--	1		--	--						1	--	Space	**L1-32**
L1-33	Space	--	1				--	--				1	--	Space	**L1-34**
L1-35	Space	--	1						--	--		1	--	Space	**L1-36**
L1-37	Spare	20 A	1		0 VA	0 VA						1	20 A	Spare	**L1-38**
L1-39	Spare	20 A	1				0 VA	0 VA				1	20 A	Spare	**L1-40**
L1-41	Spare	20 A	1						0 VA	0 VA		1	20 A	Spare	**L1-42**
		Total Load:			1924 VA		2715 VA		10 VA						
		Total Amps:			18 A		25 A		0 A						

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Other	1000 VA	100.00%	1000 VA		
Lighting	3641 VA	100.00%	3641 VA	**Total Conn. Load:**	4637 VA
				Total Est. Demand:	4637 VA
				Total Conn.:	13 A
				Total Est. Demand:	13 A

Notes:

Branch Panel: PANEL-R1

Location: ELECTRICAL ROOM 110 | **Volts:** 120/208 Wye | **A.I.C. Rating:** 18
Supply From: PANEL-MDP | **Phases:** 3 | **Mains Type:** MLO
Mounting: Surface | **Wires:** 4 | **Mains Rating:** 100 A
Enclosure: Type 1 | **MCB Rating:** 100 A

CKT	Load Name	Trip	Poles	Comments	A		B		C		Comments	Poles	Trip	Load Name	CKT
R1-1	Receptacle	20 A	1	2#12, 1#12G,1/2"C	800 VA	1200 VA					2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R1-2**
R1-3	Receptacle	20 A	1	2#12, 1#12G,1/2"C			1200 VA	1200 VA			2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R1-4**
R1-5	Receptacle	20 A	1	2#12, 1#12G,1/2"C					1200 VA	1200 VA	2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R1-6**
R1-7	Receptacle	20 A	1	2#12, 1#12G,1/2"C	600 VA	600 VA					2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R1-8**
R1-9	Fire Sprinkler	20 A	1	2#12, 1#12G,1/2"C			600 VA	180 VA			2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R1-10**
R1-11	FACP	20 A	1	2#12, 1#12G,1/2"C					600 VA	200 VA	2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R1-12**
R1-13	Receptacle	20 A	1	2#12, 1#12G,1/2"C	200 VA	200 VA					2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R1-14**
R1-15	Receptacle	20 A	1	2#12, 1#12G,1/2"C			200 VA	5040 VA			3#10, 1#10G,3/4"C	2	20 A	Equipment	**R1-16**
R1-17	Receptacle	20 A	1	2#12, 1#12G,1/2"C					800 VA	5040 VA	--	--	--	--	**R1-18**
R1-19	Receptacle	20 A	1	2#12, 1#12G,1/2"C	600 VA	1200 VA					2#8, 1#10G,3/4"C	1	20 A	Other	**R1-20**
R1-21	Receptacle	20 A	1	2#12, 1#12G,1/2"C			600 VA	600 VA			2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R1-22**
R1-23	Receptacle	20 A	1	2#12, 1#12G,1/2"C					600 VA	600 VA	2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R1-24**
R1-25	Receptacle	20 A	1	2#12, 1#12G,1/2"C	400 VA	400 VA					2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R1-26**
R1-27	Receptacle	20 A	1	2#12, 1#12G,1/2"C			800 VA	600 VA			2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R1-28**
R1-29	Receptacle	20 A	1	2#12, 1#12G,1/2"C					800 VA	1000 VA	2#10, 1#10G,3/4"C	1	20 A	Receptacle	**R1-30**
R1-31	Power	20 A	1	2#12, 1#12G,1/2"C	600 VA	600 VA					2#12, 1#12G,1/2"C	1	20 A	Power	**R1-32**
R1-33	Power	20 A	1	2#12, 1#12G,1/2"C			800 VA	200 VA			2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R1-34**
R1-35	Receptacle	20 A	1	2#10, 1#10G,3/4"C					800 VA	--		1	--	Space	**R1-36**
R1-37	Spare	20 A	1		0 VA	0 VA						1	20 A	Spare	**R1-38**
R1-39	Spare	20 A	1				0 VA	0 VA				1	20 A	Spare	**R1-40**
R1-41	Spare	20 A	1						0 VA	0 VA		1	20 A	Spare	**R1-42**
		Total Load:			7400 VA		12020 VA		12840 VA						
		Total Amps:			62 A		106 A		113 A						

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Equipment	10080 VA	100.00%	10080 VA		
Receptacle	18980 VA	76.34%	14490 VA	**Total Conn. Load:**	32260 VA
Power	3200 VA	100.00%	3200 VA	**Total Est. Demand:**	27770 VA
				Total Conn.:	90 A
				Total Est. Demand:	77 A

Notes:

Branch Panel: PANEL-R2

Location: ELECTRICAL ROOM 110 | **Volts:** 120/208 Wye | **A.I.C. Rating:** 18
Supply From: PANEL-MDP | **Phases:** 3 | **Mains Type:** MLO
Mounting: Surface | **Wires:** 4 | **Mains Rating:** 100 A
Enclosure: Type 1 | **MCB Rating:** 100 A

CKT	Load Name	Trip	Poles	Comments	A		B		C		Comments	Poles	Trip	Load Name	CKT
R2-1	Receptacle	20 A	1	2#12, 1#12G,1/2"C	600 VA	600 VA					2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R2-2**
R2-3	Receptacle	20 A	1	2#12, 1#12G,1/2"C			540 VA	600 VA			2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R2-4**
R2-5	Receptacle	20 A	1	2#12, 1#12G,1/2"C					600 VA	200 VA	2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R2-6**
R2-7	Receptacle	20 A	1	2#12, 1#12G,1/2"C	180 VA	540 VA					2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R2-8**
R2-9	Receptacle	20 A	1	2#12, 1#12G,1/2"C			180 VA	180 VA			2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R2-10**
R2-11	Receptacle	20 A	1	2#12, 1#12G,1/2"C					180 VA	180 VA	2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R2-12**
R2-13	Receptacle	20 A	1	2#12, 1#12G,1/2"C	180 VA	900 VA					2#10, 1#10G,3/4"C	1	20 A	Receptacle	**R2-14**
R2-15	Receptacle	20 A	1	2#12, 1#12G,1/2"C			180 VA	7200 VA			3#4, 1#8G,1.5"C	2	20 A	Water Heater	**R2-16**
R2-17	Receptacle	20 A	1	2#10, 1#10G,3/4"C					720 VA	7200 VA	--	--	--	--	**R2-18**
R2-19	Receptacle	20 A	1	2#12, 1#12G,1/2"C	180 VA	600 VA					2#10, 1#10G,3/4"C	1	20 A	Receptacle	**R2-20**
R2-21	Receptacle	20 A	1	2#12, 1#12G,1/2"C			400 VA	200 VA			2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R2-22**
R2-23	Receptacle	20 A	1	2#12, 1#12G,1/2"C					200 VA	200 VA	2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R2-24**
R2-25	Power	20 A	1	2#12, 1#12G,1/2"C	600 VA	200 VA					2#12, 1#12G,1/2"C	1	20 A	Receptacle	**R2-26**
R2-27	Receptacle	20 A	1	2#12, 1#12G,1/2"C			200 VA	600 VA			2#12, 1#12G,1/2"C	1	20 A	Power	**R2-28**
R2-29	Receptacle	20 A	1	2#12, 1#12G,1/2"C					200 VA	--		1	--	Space	**R2-30**
R2-31	Equipment	30 A	2	3#10, 1#10G,3/4"C	2496 VA	--						1	--	Space	**R2-32**
R2-33	--	--	--	--			2496 VA	--				1	--	Space	**R2-34**
R2-35										--		1	--	Space	**R2-36**
R2-37	Spare	20 A	1		0 VA	0 VA						1	20 A	Spare	**R2-38**
R2-39	Spare	20 A	1				0 VA	0 VA				1	20 A	Spare	**R2-40**
R2-41	Spare	20 A	1						0 VA	0 VA		1	20 A	Spare	**R2-42**
		Total Load:			7076 VA		12776 VA		9680 VA						
		Total Amps:			59 A		110 A		84 A						

Load Classification	Connected Load	Demand Factor	Estimated Demand	Panel Totals	
Equipment	4992 VA	100.00%	4992 VA		
Receptacle	8940 VA	100.00%	8940 VA	**Total Conn. Load:**	29532 VA
Power	15600 VA	100.00%	15600 VA	**Total Est. Demand:**	29532 VA
				Total Conn.:	82 A
				Total Est. Demand:	82 A

Notes:

MILNET ARCHITECTURAL SERVICES
AMERICAN INSTITUTE OF ARCHITECTS

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THE COUNTY OF HIDALGO
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ELSA, TX 78543

PROJECT NUMBER
224003

DATE
10-15-24

SHEET NUMBER
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STATE OF TEXAS
LEONEL MUNOZ
103722
LICENSED PROFESSIONAL ENGINEER

Light Fixture Schedule

Count	Tag	Lamp	Voltage	Mounting	Description	Manufacturer	Model
13	A1	LED (4000LM) (35W)	120V	LAY-IN	2X4 LAY-IN LED FLAT PANEL WITH LENS AND LED DRIVER INCLUDE ALL NECESSARY MOUNTING ACCESSORIES.	COOPER LIGHTING	24FP6440C
10	A1E	LED (4000LM) (35W)	120V	LAY-IN	2X4 LAY-IN LED FLAT PANEL WITH LENS AND LED DRIVER AND EMERGENCY BATTERY BACKUP. INCLUDE ALL NECESSARY MOUNTING ACCESSORIES.	COOPER LIGHTING	SAME AS TYPE 'A1' WITH EMERGENCY BATTERY BACKUP.
4	B1	LED (4465LM) (38W)	120V	RECESSED	2X2 RECESSED LED FLAT PANEL WITH LENS AND LED DRIVER INCLUDE ALL NECESSARY MOUNTING ACCESSORIES.	COOPER LIGHTING	22FP4240C-RMK2
2	B1E	LED (4465LM) (38W)	120V	RECESSED	2X2 RECESSED LED FLAT PANEL WITH LENS AND LED DRIVER AND EMERGENCY BATTERY BACKUP. INCLUDE ALL NECESSARY MOUNTING ACCESSORIES.	COOPER LIGHTING	SAME AS TYPE 'B1' WITH EMERGENCY BATTERY BACKUP.
18	D1	LED (4500LM) (55W)	120V	RECESSED	6" RECESSED LED DOWNLIGHT WITH LED DRIVER WITH WIDE DISTRIBUTION	COOPER LIGHTING	HC610D010-HM60525840-61MDH
7	D1E	LED (4500LM) (55W)	120V	RECESSED	6" RECESSED LED DOWNLIGHT WITH LED DRIVER WITH EMERGENCY BATTERY.	COOPER LIGHTING	SAME AS TYPE 'D1' WITH EMERGENCY BATTERY BACKUP.
14	D3	LED (3000LM) (21W)	120V	RECESSED	6" RECESSED LED DOWNLIGHT WITH LED DRIVER WITH WIDE DISTRIBUTION	COOPER LIGHTING	LD6D-30-R70-90-_-_-D010-_-_-
12	D3E	LED (3000LM) (21W)	120V	RECESSED	6" RECESSED LED DOWNLIGHT WITH LED DRIVER WITH EMERGENCY BATTERY.	COOPER LIGHTING	SAME AS TYPE 'D3' WITH EMERGENCY BATTERY BACKUP.
1	E	LED	120V	SURFACE	EMERGENCY LIGHTING UNIT W/ SELF-DIAGNOSTICS	COOPER LIGHTING	SEL17
4	E2	LED	120V	SURFACE	EXTERIOR EMERGENCY LIGHTING UNIT W/ SELF-DIAGNOSTICS	COOPER LIGHTING	SELWW5BZ
4	F1	LED (5381LM) (40W)	120V	SURFACE	4' LED STRIP LIGHT, UL LISTED. PROVIDE ALL NECESSARY MATERIALS FOR A PROPER INSTALLATION.	COOPER LIGHTING	4SNX-57SL-LW-UNV-L840-CD1-U
9	F2	LED (8583LM) (60W)	120V	SURFACE	8' LED STRIP LIGHT, UL LISTED. PROVIDE ALL NECESSARY MATERIALS FOR A PROPER INSTALLATION.	COOPER LIGHTING	8TSNX-90SL-LW-UNV-L840-CD1-U
3	V1	LED (11484LM) (94W)	120V	SURFACE	8' LED VAPORTITE FIXTURE, UL LISTED FOR USE IN WET LOCATION. PROVIDE ALL NECESSARY MATERIALS FOR A PROPER INSTALLATION.	COOPER LIGHTING	8APVTLD-SL3C3 HI POWER 4000K
5	X1	LED	120V	SURFACE	LED THERMOPLASTIC EXIT/EMERGENCY UNIT WITH SELF-DIAGNOSTICS	COOPER LIGHTING	APCH7RG
8	AA	LED (7502LM) (59W)	120V	SURFACE	LED WALL LUMINAIRE, WET LOCATION RATED, UL LISTED	COOPER LIGHTING	GWC-SA1-C-740-U-T4W-XX
2	BB	LED (1500LM) (21W)	120V	SURFACE	LED RECESSED DOWNLIGHT FIXTURE, LENSED, WET LOCATION RATED	COOPER LIGHTING	HC610D010-HM60525840-61MDH
1	CC	LED (58216LM) (308W)	120V	POLE	LED AREA LUMINAIRE, POLE MOUNT LUMINAIRE, INCLUDE BASE COVER, RATED FOR WET LOCATION, UL LISTED, POLE SHALL BE SIZE FOR MIN. 130 MPH, INCLUDE VIBRATION DAMPERS	COOPER LIGHTING	FIXTURE MFR. COOPER LIGHTING GALN-SA4C-740-U-5WQ-XX POLE MFR. VALMONT #DS340-5006300-D1-FP-DB-FBC-AB
4	DD	LED (25473LM) (154W)	120V	POLE	LED AREA LUMINAIRE, POLE MOUNT LUMINAIRE, INCLUDE BASE COVER, RATED FOR WET LOCATION, UL LISTED, POLE SHALL BE SIZE FOR MIN. 130 MPH, INCLUDE VIBRATION DAMPERS	COOPER LIGHTING	FIXTURE MFR. COOPER LIGHTING GALN-SA4C-740-U-T2-XX POLE MFR. VALMONT #DS340-5006300-D2-FP-DB-FBC-AB
2	FF	LED (2) (18,759LM) (169W)	120V	SURFACE	LED FLOOD LIGHT FIXTURE RATED FOR WET LOCATION AND INCLUDE LED DRIVER.	COOPER LIGHTING	DSXF3-6-P2-70CRI-MFL--MVOLT--XX

GENERAL NOTES:
1.) EQUAL MANUFACTURER SHALL BE ACCEPTABLE WITH EQUAL PERFORMANCE OF SPECIFIED EQUIPMENT AND APPROVED BY ENGINEER.
2.) SUBMIT EQUAL MANUFACTURERS TO ENGINEER 10 DAYS PRIOR TO BID DATE.
3.) SUBMIT LIGHT FIXTURES CUTSHEETS TO OWNER FOR APPROVAL PRIOR TO ORDER.
4.) CONTRACTOR SHALL VERIFY THAT ANY IRRIGATION SPRINKLER HEAD IS AWAY FROM ANY LIGHT POLE A MINIMUM OF 75' TO AVOID CONSISTENT WATER TO LIGHT POLE. COORDINATE WITH IRRIGATION CONTRACTOR PRIOR TO ANY WORK.
5.) ANCHOR BOLTS SHALL BE OF NON-CORROSIVE MATERIAL (STAINLESS STEEL).

Electrical Disconnect Schedule

Mark	Description
AHU-1	60AMP, 1-PHASE, 3W, N1, 208V, S/N, N.F., H.D. DISCONNECT
AHU-2	60AMP, 3-PHASE, 4W, N1,208V, S/N, N.F., H.D. DISCONNECT
AHU-3	60AMP, 3-PHASE, 4W, N1,208V, S/N, N.F., H.D. DISCONNECT
AHU-4	60AMP, 3-PHASE, 4W, N1,208V, S/N, N.F., H.D. DISCONNECT
CU-1	60AMP, 1-PHASE, 3W, N3R,208V, S/N, H.D. FUSED DISCONNECT
CU-2	60AMP, 3-PHASE, 4W, N3R,208V, S/N, H.D. FUSED DISCONNECT
CU-3	60AMP, 3-PHASE, 4W, N3R,208V, S/N, H.D. FUSED DISCONNECT
CU-4	60AMP, 3-PHASE, 4W, N3R,208V, S/N, H.D. FUSED DISCONNECT
FCCU-1	30AMP, 1-PHASE, 4W, N3R,208V, S/N, H.D. FUSED DISCONNECT
ICE MAKER	30AMP, 1-PHASE, 3W, N1,120V, S/N, N.F., H.D. DISCONNECT
UH-1	30AMP, 1-PHASE, 3W, N1, 208V, S/N, N.F., H.D. DISCONNECT
WH-1	60AMP, 3-PHASE, 4W, N1,208V, S/N, N.F., H.D. DISCONNECT

GENERAL NOTES:
1.) REFER TO BREAKER SIZE FOR FUSE SIZE.
2.) REFER TO PANELBOARD FOR DISCONNECT PHASES AND VOLTAGE.

RELAY LIGHTING CONTROL PANEL
Master CABINET CIRCUIT SCHEDULE
208/120VAC, 1 PHASE

PANEL NAME: LCP1

PANEL LOCATION:
PANEL DESCRIPTION: NETWORKING 16 Relay Cabinet:
CATALOG NUMBER: XXX
PANEL FEED: L1
PANEL ID: Master
MOUNTING: Surface

RELAY NO.	RELAY TYPE	A	PNL CIRCUIT	LOAD VAC	LOAD W/VA	LOAD CIRCUIT DESCRIPTION
1	1	20	L1-1	120V	1200	Lighting
3	1	20	L1-6	120V	1200	EXTERIOR Lighting
5	1	20	L1-8	120V	1200	EXTERIOR Lighting
7	1	20	L1-8	120V	1200	EXTERIOR Lighting (30%)
9	1	20	L1-10	120V	1200	EXTERIOR Lighting
11	1	20		120V	1200	SPARE
13	1	20		120V	1200	SPARE
15	1	20		120V	1200	SPARE

RELAY NO.	RELAY TYPE	A	PNL CIRCUIT	LOAD VAC	LOAD W/VA	LOAD CIRCUIT DESCRIPTION
2	1	20	L1-5	120V	1200	Lighting
4	1	20	L1-7	120V	1200	EXTERIOR Lighting
6	1	20	L1-9	120V	1200	EXTERIOR Lighting
8	1	20	L1-9	120V	1200	EXTERIOR Lighting (30%)
10	1	20		120V	1200	SPARE
12	1	20		120V	1200	SPARE
14	1	20		120V	1200	SPARE
16	1	20		120V	1200	SPARE

LEGEND:
1 = RELAY-1-POLE,20A, UP TO 277VAC
2 = RELAY-2-POLE, 2-POLE, 20A, UP TO 480VAC
A=AMPS
3 = FAN RELAY 1-POLE, 20AMP, 120V
NOTES:
1. INCLUDE EXTERIOR PHOTO CELL,SOFTWARE PROGRAMMING, COMMUNICATION CARD AND GRAPHICAL CONTROLS.
2. VERIFY WITH OWNER FOR ALL PROGRAMMING SEQUENCE.
3. REFER TO SPECIFICATION 16515.
4. PROVIDE DEDICATED 20AMP 120V FROM NEAREST 120/208V PANEL.
5. INCLUDE ALL TRAINING FOR PROGRAMMING AND STARTUP IN CONTRACT. REFER TO SPECIFICATIONS.
6. INCLUDE REMOTE CONTROL OPTION. OWNER TO PROVIDE DATA INPUT.
7. INCLUDE ASTRONOMICAL TIME CLOCK.

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Project number: 24.2.29

10-15-24

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LEONARDO J. MUNOZ
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REGISTERED PROFESSIONAL ENGINEER

MILNET
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REMOTE OPERATIONS CENTER
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708 E. EDINGBURG AVE.
ELSA, TX 78543

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DATE
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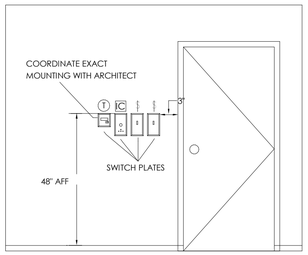
E4.2

01

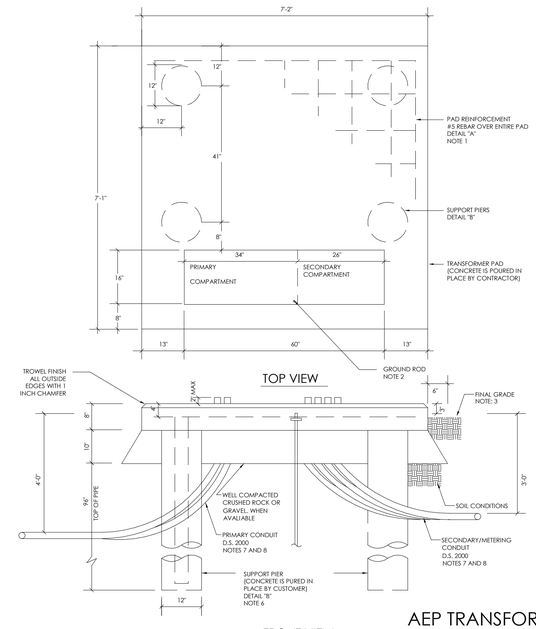
NOTE:
VERIFY WITH DIVISION-15 FOR THERMOSTAT LOCATION AND HEIGHT.



SWITCH PLATE LOCATION DETAIL
NO SCALE

02

CONCRETE PAD & PIERS FOR THREE PHASE PAD-MOUNTED TRANSFORMER



AEP TRANSFORMER CONCRETE PAD DETAIL
NO SCALE

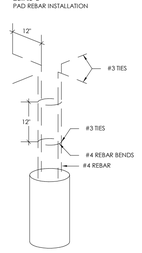
AMERICAN ELECTRIC POWER COMPANY DISTRIBUTION STANDARDS

DETAIL - "B" - PIER REBAR INSTALLATION

NOTE:

1. SLAB REINFORCEMENT SHALL BE #5 REBARS, ON CENTER (OC) SPACING TO FOLLOW DIMENSIONS SHOWN ON THE DRAWING WITH 4" COVER. REINFORCING BARS SHALL CONFORM TO ASTM A615 GRADE 60. CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4000 PSI AFTER 28 DAYS.
2. FOR GROUND ROD PLACMENT, REFER TO DS 2235, 2236, OR 2237.
3. FINAL GRADE SHALL BE ESTABLISHED BEFORE INSTALLATION OF PAD.
4. CONCRETE PAD WITH PIERS IS TO BE INSTALLED OF PAD.
5. PIERS SHALL BE 12" MINIMUM IN DIAMETER, 8 FEET DEEP WITH 4 - #4 VERTICALE REBAR AND #3 TIES AT 12" ON CENTER (O/C), AND PROVIDE A MINIMUM 3" COVER. THE #4 BEND BARS SHOULD BE 12" LONG IN THE HORIZONTAL DIRECTION..
6. PIERS REBAR BENT IN THE HORIZONTAL DIRECTION SO THAT IT MAY TIE IN WITH PAD REBAR.

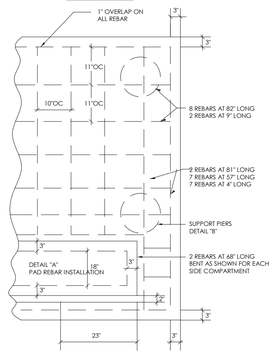
DETAIL "B" PAD REBAR INSTALLATION



DETAIL - "A" - PAD INSTALLATION

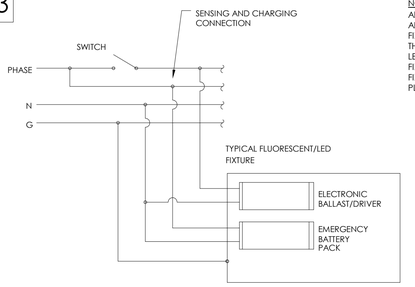
7. THE NUMBER AND PLACEMENT OF SECONDARY CONDUIT TO BE DETERMINED BY ENGINEERING. CONDUIT MAY EXTEND IN ANY DIRECTION AS REQUIRED BY THE CUSTOMER.
8. BURIAL DEPTH OF CONDUIT IS DEFINED AS THE DISTANCE BETWEEN FINAL GRADE AND THE TOP OF THE CONDUIT. UNLESS OTHERWISE DESIGNATED BY ENGINEERING, CONDUITS SHALL BE INSTALLED AT A BURIAL DEPTH OF NOT LESS THAN 4'-0" AND SECONDARY CONDUITS SHALL BE INSTALLED AT A BURIAL DEPTH OF NOT LESS THAN 3'-0". THESE INITIAL DEPTHS ARE TO ALLOW FOR CHANGES TO THE SURFACE CONDITIONS. LOCAL AGREEMENTS AND CODES MAY REQUIRE ADDITIONAL DEPTH. IF OTHER ARE KNOWN EXTENSIVE CHANGES TO THE FINAL GRADE SUCH THAT THEIR DEPTHS ARE NOT MAINTAINED, CORRECTIVE ACTION SHALL BE TAKEN.

TOP VIEW



CONCRETE PAD AND PIERS FOR THREE PHASE PAD-MOUNTED TRANSFORMER, HIGH VOLUME CLAY OR SAND TYPE SOIL APPLICATIONS 75KVA - 2500KVA 25KV AND BELOW

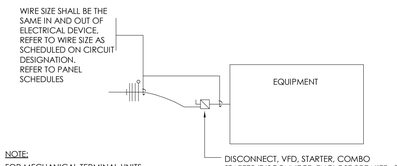
03



NOTE:
ALL EXIT LIGHT FIXTURE AND EMERGENCY FIXTURES SHALL BE ON THE NON-SWITCHED LEG. REFER TO LIGHT FIXTURE SCHEDULE FOR FIXTURE TYPE AND PLANS.

TYPICAL EMERGENCY LIGHT FIXTURE SCHEMATIC
NO SCALE

04



NOTE:
FOR MECHANICAL TERMINAL UNITS, REFER TO MECHANICAL EQUIPMENT CONNECTION SCHEDULE

DISCONNECT, VFD, STARTER, COMBO STARTER/DISCONNECT, ENCLOSE BREAKER, OR ANY MEANS OF CONTROLS/DISCONNECT.

EQUIPMENT CIRCUIT DETAIL
NO SCALE

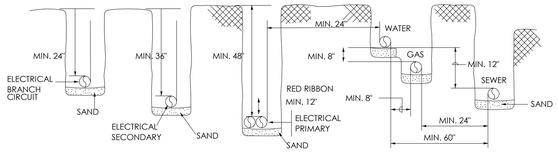
05

CLEAR TRENCH OF ALL ROCKS AND DEBRIS BEFORE ADDING SAND CUSHION.

COMPACT TRENCH FILL TO 95% PROCTOR DENSITY.

MAINTAIN A MINIMUM OF 60 INCHES UNDISTURBED EARTH BETWEEN PARALLEL WATER AND SEWER LINES OR SUPPORT WATER LINE ON SEPARATE SHELF A MINIMUM OF 12" ABOVE SEWER LINE.

MAINTAIN A MINIMUM OF 24" HORIZONTALLY BETWEEN ELECTRICAL PRIMARY AND SEWER. MAINTAIN A MINIM OF 12" VERTICALLY OR 24" HORIZONTALLY BETWEEN ELECTRICAL PRIMARY AND WATER LINES, GAS LINES, TELEPHONE RACEWAYS AND CABLE RACEWAYS.

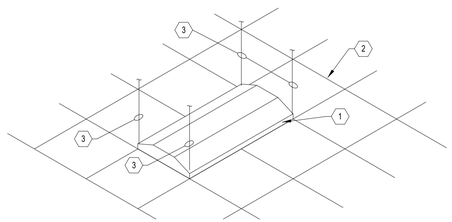


TRENCH DETAIL
NO SCALE

06

KEYED NOTES:

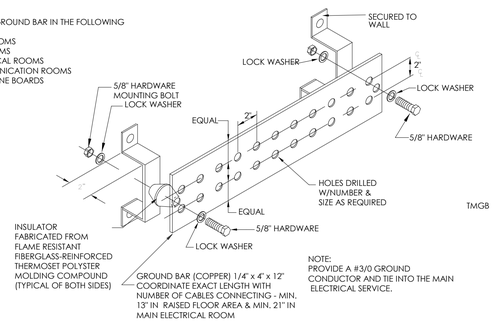
1. 2'x 4' LAY-IN LED/FLUORESCENT FIXTURE
2. SUSPENDED CEILING
3. TIE WIRE, CONNECT TO ALL FOUR CORNERS OF FIXTURE TO TOP OF STRUCTURE, INDEPENDENT OF CEILING SUPPORTS.



TYPICAL LAY-IN FIXTURE SUPPORT
NO SCALE

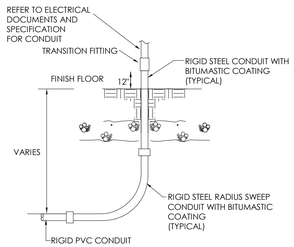
07

PROVIDE GROUND BAR IN THE FOLLOWING ROOMS:
1. MDF ROOMS
2. IDF ROOMS
3. ELECTRICAL ROOMS
4. COMMUNICATION ROOMS
5. TELEPHONE BOARDS



WALL MOUNTED SINGLE-POINT GROUND BAR DETAIL
NO SCALE

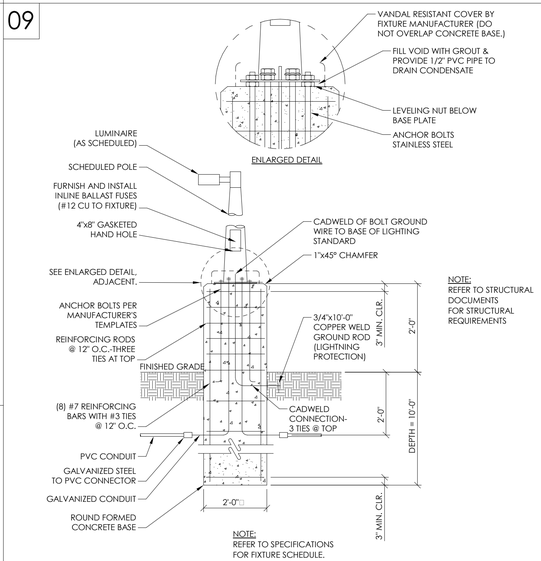
08



NOTES:
1. SEE ELECTRICAL DOCUMENTS FOR SIZES.
2. THIS APPLIES TO POWER AND SPECIAL SYSTEMS CONDUITS.

TYPICAL UNDERGROUND CONDUIT -ABOVE GROUND INSTALLATION
NO SCALE

09

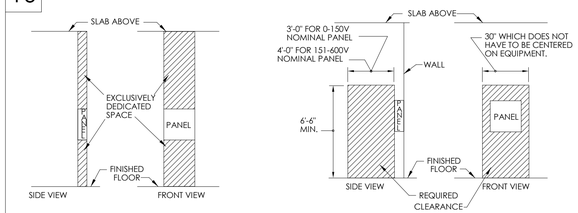


NOTE:
REFER TO STRUCTURAL DOCUMENTS FOR STRUCTURAL REQUIREMENTS

NOTE:
REFER TO SPECIFICATIONS FOR FIXTURE SCHEDULE.

PARKING LOT LIGHT POLE BASE
NO SCALE

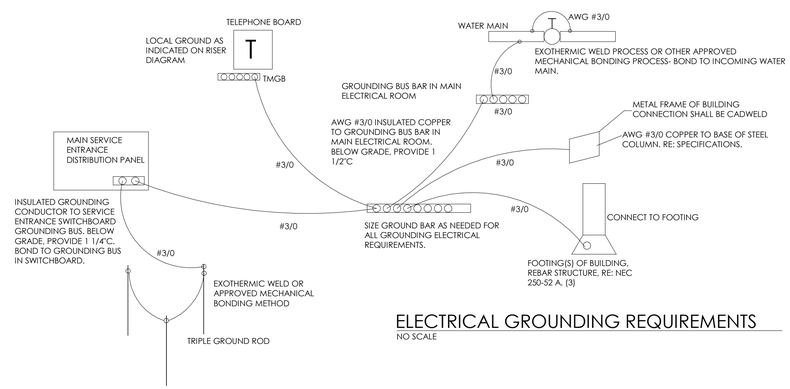
10



NOTE:
REFER TO THE LATEST NATIONAL ELECTRICAL CODE AND LOCAL CODES.

TYPICAL PANEL BOARD REQUIRED CLEARANCE
NO SCALE

11



ELECTRICAL GROUNDING REQUIREMENTS
NO SCALE

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10-15-24

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AMERICAN INSTITUTE OF ARCHITECTS

REMOTE OPERATIONS CENTER
PRECINCT 1
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708 E. EDINGBURG AVE.
ELSA, TX 78543

PROJECT NUMBER
224003

DATE
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SHEET NUMBER
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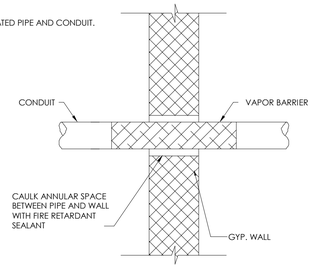
01

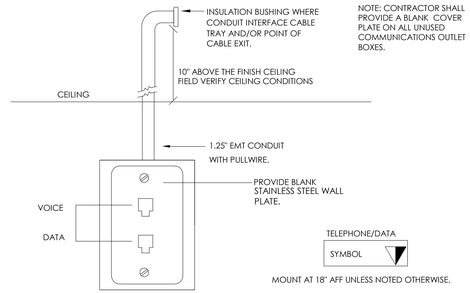
NOTE: WHERE PIPING IS EXPOSED AT FINISHED WALLS, PROVIDE FLUSH MOUNTED SLEEVE AND ESCUTCHEON PLATES. (CONTRACTOR MAY USE FIELD FABRICATED S.S. PLATE).

NOTE: SIMILAR FOR UNINSULATED PIPE AND CONDUIT.



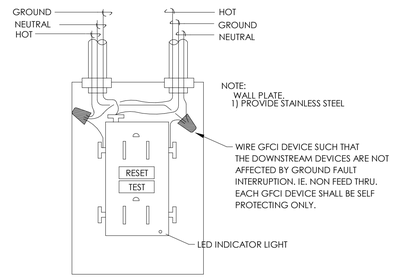
CONDUIT THROUGH FIRE RATED WALL
NO SCALE

02



VOICE/ DATA DETAIL
NO SCALE

03

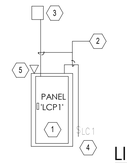


GFI RECEPTACLE- WIRING DIAGRAM
NO SCALE

04

KEYED NOTES:

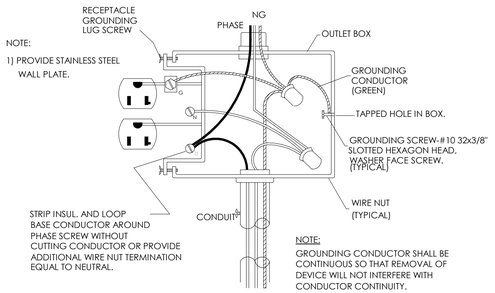
1. LIGHTING CONTROL RELAY PANELS. REFER TO SPECIFICATIONS EACH MAITER RELAY PANEL SHALL INCLUDE DISPLAY MONITOR.
2. PROVIDE COMMUNICATION CABLE AS RECOMMENDED BY MANUFACTURER IN A 3/4"C. REFER TO PLAN FOR PANEL LOCATIONS.
3. PROVIDE EXTERIOR PHOTO CELL AS RECOMMENDED BY MANUFACTURER.
4. PROVIDE OVERRIDE SWITCH STATION. PROVIDE WIRING AS RECOMMENDED BY MANUFACTURER.
5. PROVIDE DATA CONNECTION TO MASTER PANEL.



NOTE:
1.) ALL EXTERIOR CIRCUITS SHALL BE PROGRAMMED AT OWNERS DIRECTIONS.
2.) MASTER RELAY PANEL "LCP1" SHALL INCLUDE CLOCK, PHOTOCELL, SOFTWARE PROGRAMMING, COMMUNICATION CARD AND GRAPHICAL CONTROLS.
3.) ALL SLAVE PANELS SHALL INCLUDE GRAPHICAL CONTROLS.

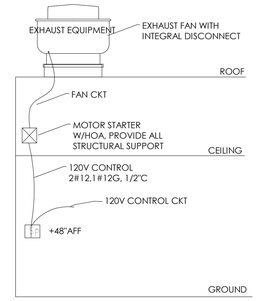
LIGHTING RELAY PANEL - SCHEMATIC DETAIL
NO SCALE

05



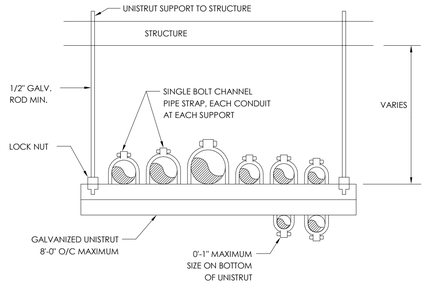
TYPICAL RECEPTACLE GROUNDING DETAIL
NO SCALE

06



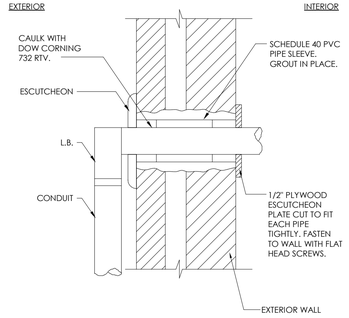
EXHAUST ROOF MOUNTED EQUIPMENT DETAIL
NO SCALE

07



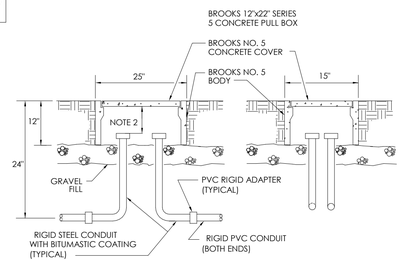
SUPPORT DETAIL FOR MULTIPLE CONDUIT HORIZONTAL RUNS
NO SCALE

08



CONDUIT ENTRY THROUGH EXTERIOR
NO SCALE

09



NOTES:
1. SEE PLAN FOR CONDUIT ORIENTATION
2. VARIES - MIN. 6", MAX-9"

TYPICAL PULLBOX DETAIL
NO SCALE

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10-15-24
STATE OF TEXAS
LEONARDO MUNOZ

GENERAL NOTES - SPECIAL SYSTEMS

A. COORDINATE EXACT LOCATION AND MOUNTING HEIGHT OF ALL POWER SOURCE WIRING IN ACCORDANCE WITH ARCHITECTURAL MILLWORK.
B. PROVIDE CLEAR VANDAL COVER WITH STOPPER II OPTION FOR ALL FIRE ALARM PULL STATIONS.
C. EQUIPMENT AS FURNISHED OF A SINGLE MANUFACTURER.
D. COORDINATE EXACT LOCATION OF ALL MECHANICAL EQUIPMENT IN ACCORDANCE MECHANICAL DRAWINGS.
E. ALL CONDITS SHALL REAMED AND COMPLETE WITH CONNECTORS AND INSULATED BUSHINGS AT BOTH ENDS.
F. ALL DEVICES SHOWN ON DRAWINGS ARE SYMBOLIC ONLY. THE ENTIRE FIRE ALARM SYSTEM, SHALL BE IN FULL COMPLIANCE AND MEET ALL CODES AND EQUIREMENTS OF THE LOCAL ADMINISTRATIVE AUTHORITY. ANY MODIFICATIONS REQUIRED TO PROVIDE COMPLIANCE SHALL BE MADE AT NO ADDITIONAL COST TO THE OWNER OR ARCHITECT/ ENGINEER.
G. FIRE ALARM LICENSE HOLDER SHALL ASSUME ALL RESPONSIBILITY FOR DESIGN AND SUBMIT DRAWGINGS TO JURISDICTION HAVING AUTHORITY AND ABIDE BY ALL OTHER REQUIREMENTS PER NFPA.
H. ALL SPECIAL SYSTEM CONDUITS SHALL BE STUBBED UP ABOVE THE CEILING LEVEL. IF CABLE TRAY IS PRESENT, STUBBED CONDUITS TO CABLE TRAY.

ELECTRICAL KEYNOTES

1	PROVIDE 1.5" CONDUIT TO EACH FLOOR BOX FOR DATA, STUB IN WALL TO CEILING LEVEL.
2	3/4"X8'HX4'W PLYWOOD TELEPHONE BOARD FINISHED ONE SIDE. PROVIDE GROUND BAR AND TIE INTO ELECTRICAL GROUNDING SYSTEM VIA WIRE #4.
3	COORDINATE EXACT LOCATION OF FLOOR BOX WITH OWNER/ARCHITECT PRIOR TO ANY WORK.
4	PROVIDE FIRE ALARM DEVICE FOR RANGE HOOD FIRE SUPPRESSION SYSEM. TIE INTO FIRE ALARM SYSTEM.
5	PROVIDE (3)-1.5" CONDUIT TO EACH FLOOR BOX FOR DATA, STUB IN WALL TO CEILING LEVEL.

1 ELECTRICAL TECHNOLOGY FLOOR PLAN - FIRST FLOOR
3/16" = 1'-0"

DATA WIRING QUANTITIES LEGEND

(APPLIES TO ALL ET'S SHEETS)

#X = NUMBER OF CAT-6A DROPS

#X = NUMBER OF CAT-6A DROPS
FLOOR BOX

2 = NUMBER OF CAT-6A DROPS
(PROVIDE 2-DATA TO EACH WIRELESS ACCES POINT)

#X = NUMBER OF CAT-6A DROPS
(PROVIDE DATA TO EACH CAMERA)

#X = NUMBER OF CAT-6A DROPS
PR (PROVIDE DATA TO EACH PROJECTOR)

DS1
DIGITAL SIGNAGE SYMBOL: PROVIDE 65" COMMERCIAL GRADE TV DISPLAY BY LG OR SAMSUNG WITH TILT WALL-MOUNT BRACKET. DISPLATY MUST HAVE AT LEAST (2) HDMI CONNECTIONS, (1) NETWORK CONNECTION, (1) AUDIO INPUT AND RS232 CONTROL.
INCLUDE CAT 6A CABLE TO NEAREST COMMUNICATION CLOSET. PROVIDE DUAL 120V ELECTRICAL OUTLET. MOUNT POWER AND DATA OUTLETS AT 72" AFF.
PROVIDE BLACK BOX MEDIACENTO VX-HDMI-HDIP-RX RECEIVER AT EACH TV DISPLAY AND (1) BLACK BOX MEDIACENTO VX-HDMI-HDIP-TX AT ROOM IDF D123.

NOTE:
1. REFER TO DIVISION 26, 27 & 28 FOR SPECIFICATIONS.
2. FIELD VERIFY EXACT LOCATIONS WITH OWNER.

CAMERA LEGEND (APPLIES TO ALL ET'S SHEETS)

CAM1	MFR. AXIS # P3265-V-FIXED INDOOR CAMERA
CAM2	MFR. AXIS # P3265-LVE - FIXED OUTDOOR CAMERA
CAM3	MFR. AXIS # P3715-PLVE - PANORAMIC CAMERA
CAM4	MFR. AXIS # Q6315-LE - PTZ OUTDOOR CAMERA

NOTE 1: FOR ALL CAMERAS, PROVIDE REQUIRED BRACKETS FOR THE LOCATION WHERE IS TO BE MOUNTED
NOTE 2: FOR OUTDOOR CAMERAS, PROVIDE SURGE PROTECTOR PER SPECIFICATIONS.
NOTE: 3 CAT 6A CABLING NETWORK FOR ALL CAMERAS TO BE INCLUDED IN PROPOSAL AND ROUTE BACK TO THE NEAREST MDF/IDF CLOSET.

NOTE:
1. REFER TO DIVISION 26, 27 & 28 FOR SPECIFICATIONS.
2. FIELD VERIFY EXACT LOCATIONS WITH OWNER.

ACCESS CONTROL/INTRUSION LEGEND

(APPLIES TO ALL ET'S SHEETS)

CR	CARD READER
ACC	ACCESS CONTROL PANEL
SEC	SECURITY PANEL JUNCTION BOX
DC	SECURITY DOOR CONTACT SENSOR - STUB 1/2"C ABOVE CEILING FROM OUTLET BOX
MD	SECURITY MOTION DETECTOR SENSOR - STUB 1/2"C ABOVE CEILING FROM OUTLET BOX
KP	SECURITY KEY PAD - STUB 3/4"C ABOVE CEILING FROM OUTLET BOX
	INTRUSION EXTERIOR SPEAKER - JBOX WITH 3/4"C

NOTE:
1. REFER TO DIVISION 26, 27 & 28 FOR SPECIFICATIONS.
2. FIELD VERIFY EXACT LOCATIONS WITH OWNER.

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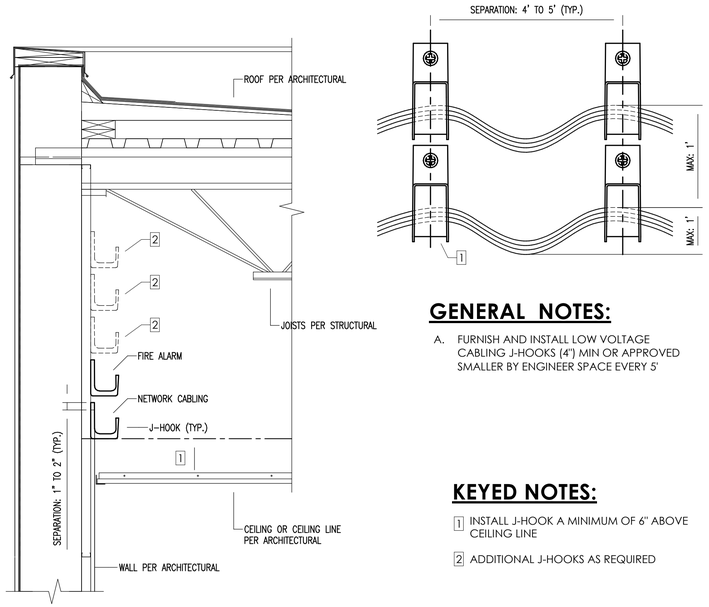
01



GENERAL NOTES:

A. FURNISH AND INSTALL LOW VOLTAGE CABLING J-HOOKS (4") MIN OR APPROVED SMALLER BY ENGINEER SPACE EVERY 5'

KEYED NOTES:

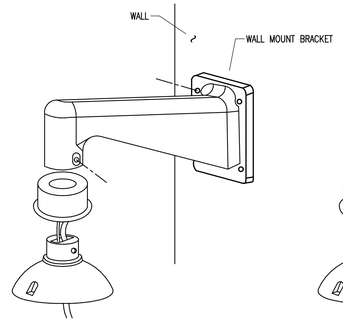
1 INSTALL J-HOOK A MINIMUM OF 6" ABOVE CEILING LINE

2 ADDITIONAL J-HOOKS AS REQUIRED

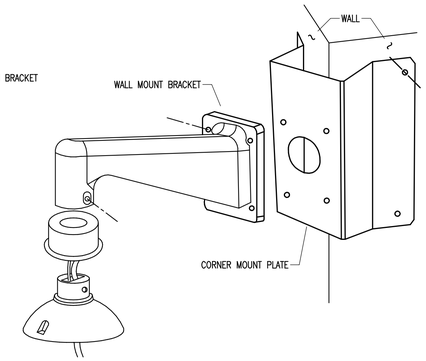
TYPICAL J-HOOK INSTALLATION DETAIL

SCALE: N.T.S

02



TYPICAL WALL MOUNT

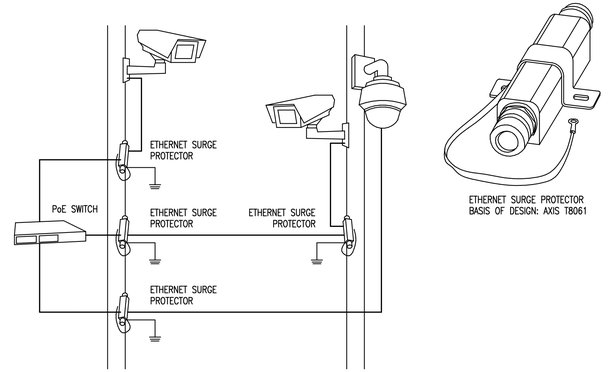


TYPICAL CORNER WALL MOUNT

CAMERA WALL MOUNT DETAIL WITH CORNER MOUNT

SCALE: N.T.S

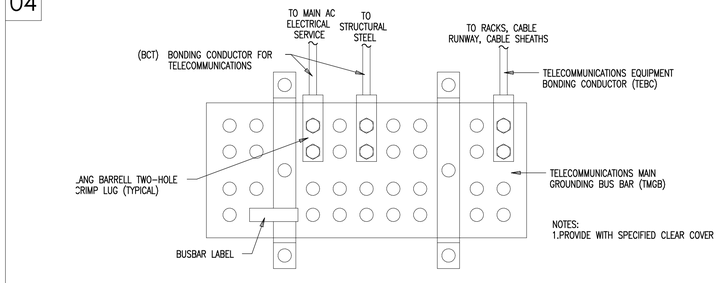
03

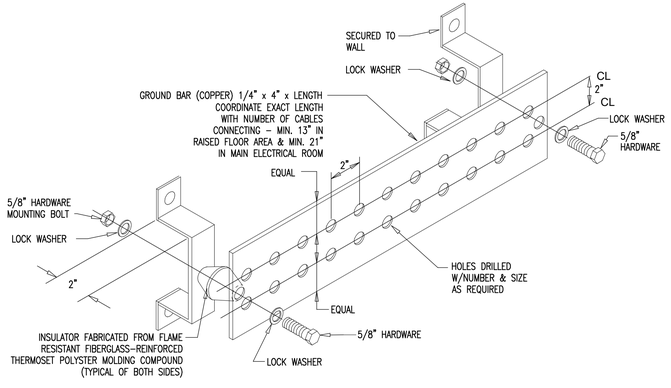


ETHERNET SURGE PROTECTION DETAIL

SCALE: N.T.S

04

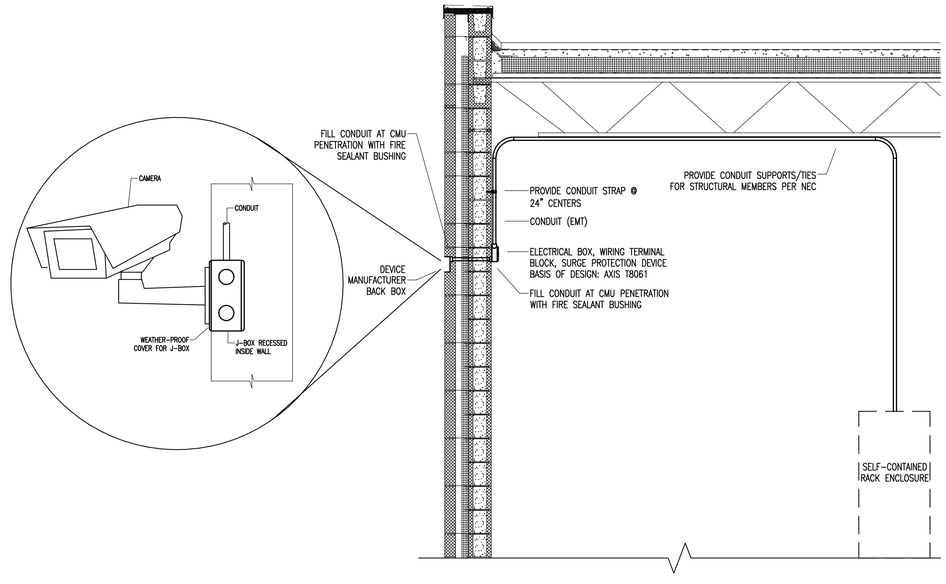




WALL MOUNTED TMBG DETAIL

SCALE: N.T.S

05



CONDUIT PENETRATION DETAIL

SCALE: N.T.S

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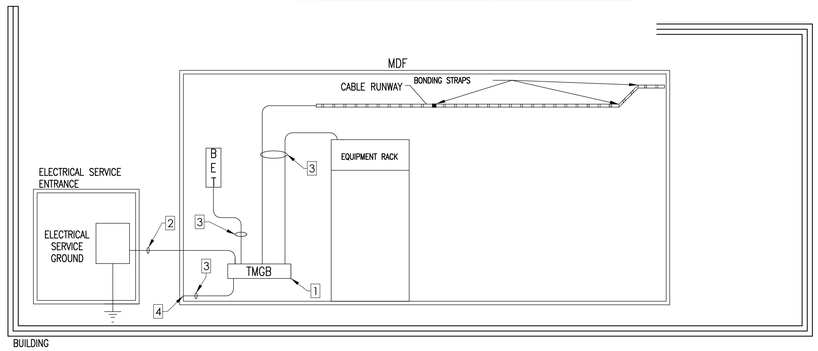
KEYED NOTES:

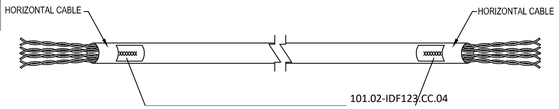
1. TELECOMMUNICATIONS MAIN GROUNDING BUS BAR (TMGB)
2. TELECOMMUNICATIONS BONDING CONDUCTOR (TBC)
3. TELECOMMUNICATIONS BONDING CONDUCTOR (TBC)
4. CONNECT TO GROUNDED BUILDING STEEL WHEN EXPOSED IN ROOM.
5. TELECOMMUNICATIONS BONDING BACKBONE (TBB)

TBB/GE linear length m (ft)	TBB/GE size (AWG)
less than 4 (13)	6
4 – 6 (14 – 20)	4
6 – 8 (21 – 26)	3
8 – 10 (27 – 33)	2
10 – 13 (34 – 41)	1
13 – 16 (42 – 52)	1/0
16 – 20 (53 – 66)	2/0
20 – 26 (67 – 84)	3/0
26 – 32 (85 – 105)	4/0
32 – 38 (106 – 125)	250 kcmil
38 – 46 (126 – 150)	300 kcmil
46 – 53 (151 – 175)	350 kcmil
53 – 76 (176 – 250)	500 kcmil
76 – 91 (251 – 300)	600 kcmil
Greater than 91 (301)	750 kcmil

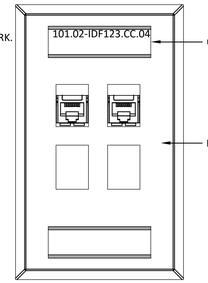


TYPICAL GROUNDING DIAGRAM
SCALE: N.T.S

02



NOTE:
1.COORDINATE WITH OWNER ON LABELS PRIOR TO ANY WORK.
2.COLOR FOR CABLE RJ-45 SHALL BE AS FOLLOWS.
A. BLUE - DATA
B. WHITE - AP
C .YELLOW - CAMERAS
D. GREEN - MISC.
VERIFY WITH OWNER PRIOR TO ANY WORK.



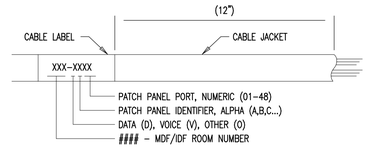
LABEL SCHEME
1. Identifies and locates room number.
2. Identifies and locates jack in room.
3. Identifies and locates the IDF number.
3. Identifies and locates the patch panel in IDF.
4. Identifies and locates the port in the patch panel.

For cable in Classroom/Office room #101, room's jack number 2, IDF Rm.# 123, connected to the 3rd Patch panel in IDF using Port #4:

101.02-IDF123.CC.04

TYPICAL DATA CABLING LABELING SCHEME
SCALE: N.T.S

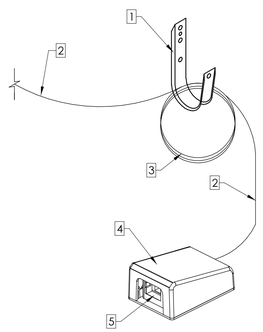
03



NOTES:
1. DETAIL SHOWN REPRESENTS A 4–PAIR HORIZONTAL LINK TERMINATING IN A TELECOMMUNICATIONS SPACE ON A RACK MOUNT PATCH PANEL.

HORIZONTAL LINK CABLE LABEL DETAIL
SCALE: N.T.S

04

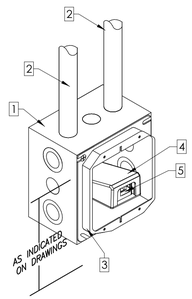


KEYED NOTES:

1. J-HOOK ABOVE ACCESSIBLE CEILING
2. DATA CABLE ABOVE ACCESSIBLE CEILING
3. 20 FOOT SERVICE LOOP ABOVE ACCESSIBLE CEILLING NEATLY COILED AND SECURED TO J-HOOK
4. SURFACE MOUNT BOX ABOVE ACCESSIBLE CEILING AND SECURED TO BUILDING STRUCTURE
5. RJ-45 INSERT

TYPICAL ABOVE ACCESSIBLE CEILING DATA OUTLET
SCALE: N.T.S

05

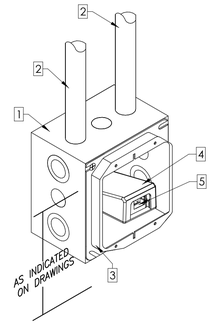


KEYED NOTES:

1. 4 11/16" X 4 11/16" X 2 1/8" RECESSED DOUBLE GANG BOX
2. 1" EMT CONDUIT FROM DOUBLE GANG BOX WITH 200 LBS PULL STRING AND NYLON BUSHING STUBBED OUT ABOVE ACCESSIBLE CEILING IN THE SAME ROOM WHERE THE DEVICE IS LOCATED. IF THE ROOM WHERE THE DEVICE IS LOCATED DOES NOT HAVE AN ACCESSIBLE CEILING, THE CONDUIT SHALL ROUTE TO THE NEAREST ACCESSIBLE CEILING OFF OF A MAIN CORRIDOR. CONDUIT PATHWAY SHALL TAKE THE SHORTEST ROUTE TO THE APPLICABLE MDF/IDF ROOM TO MINIMIZE THE CABLE LENGTH
3. DOUBLE GANG PLASTER RING
4. SURFACE MOUNT BOX INSIDE THE 4 11/16" X 4 11/16" X 2 1/8" DOUBLE GANG BOX
5. RJ-45 INSERT

TYPICAL WALL-MOUNTED WIRELESS ACCESS POINT
SCALE: N.T.S

06



KEYED NOTES:

1. 4 11/16" X 4 11/16" X 2 1/8" RECESSED DOUBLE GANG BOX
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3. DOUBLE GANG PLASTER RING
4. SURFACE MOUNT BOX INSIDE THE 4 11/16" X 4 11/16" X 2 1/8" DOUBLE GANG BOX
5. RJ-45 INSERT

TYPICAL CONDUIT ROUGH-IN FOR SURVEILLANCE CAMERA/ACCESS POINT WITHOUT ACCESSIBLE CEILING
SCALE: N.T.S

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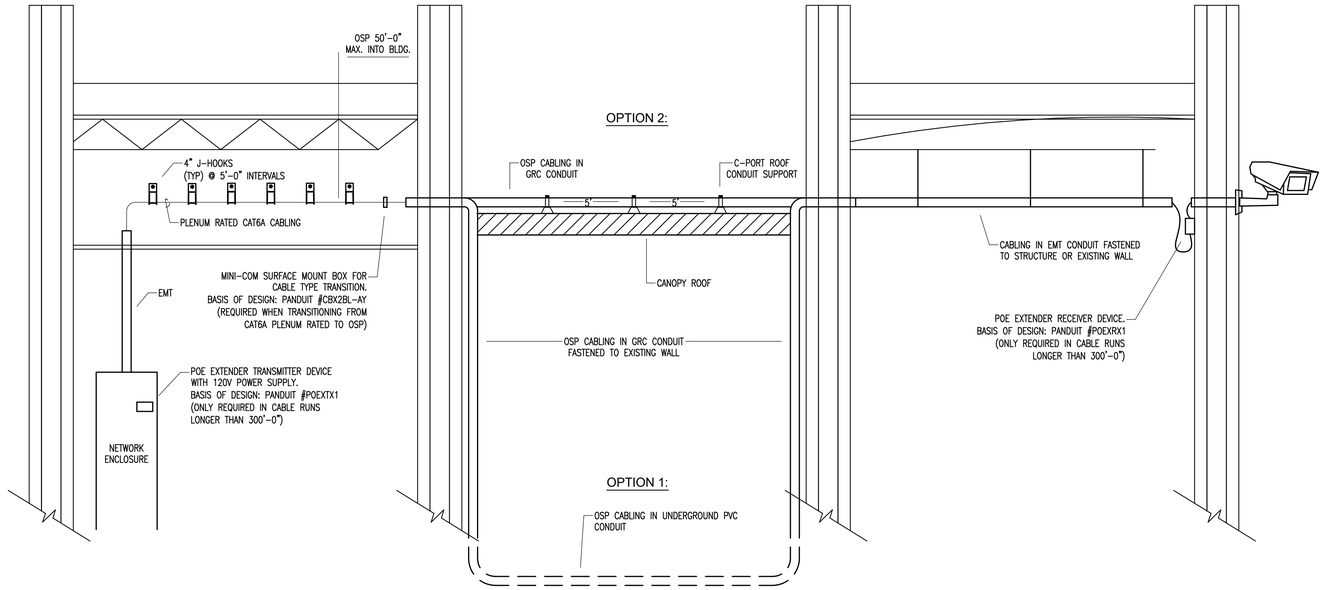
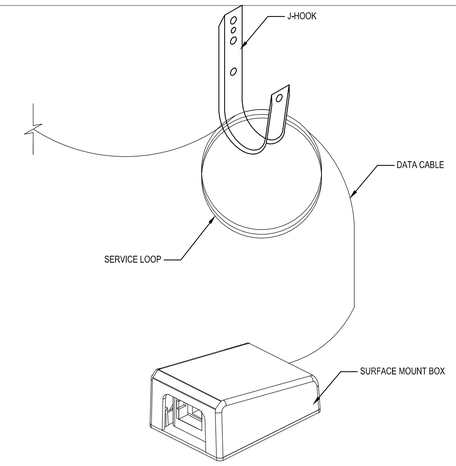


INTERIOR - PLENUM SPACE | EXTERIOR | INTERIOR - EXPOSED CEILING

TYPICAL CAMERA CABLE INSTALLATION

SCALE: N.T.S

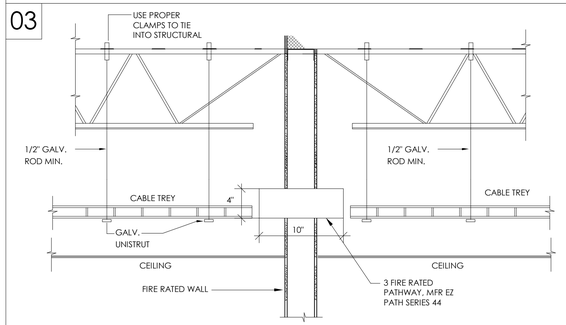
02



TYPICAL ABOVE ABOVE ACCESSIBLE CEILING LABELING SCHEME

SCALE: N.T.S

03

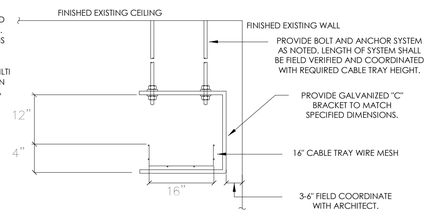


FIRE WALL PENETRATION CABLE TRAY DETAIL

NO SCALE

04

NOTE:
1. PROVIDE SUPPORT AS SHOWN AT EVERY 48" O.C.
2. COORDINATE WITH ELECTRICAL PLANS AND CEILING FOR HEIGHTS.
3. REFER TO SPECIFICATIONS FOR DETAILS AND REQUIREMENTS.
4. ALL FASTENERS SHALL BE HILTI - (BOLT) - TZ (EXPANSION ANCHOR). INCLUDE A COMPLETE SYSTEM.

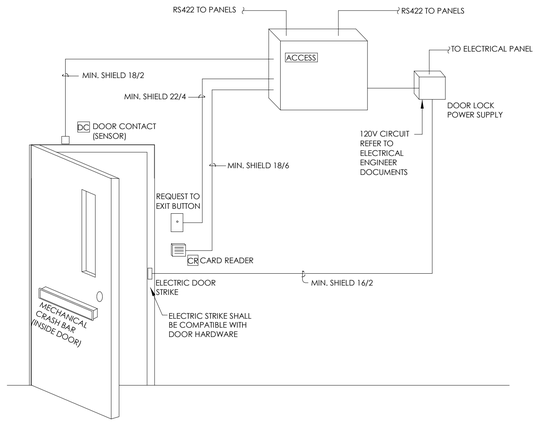


CABLE TRAY MOUNTING DETAIL

NO SCALE

05

GENERAL NOTE:
A.) EVERY DOOR WITH ACCESS CONTROL SHALL INCLUDE THE FOLLOWING SHOWN OR NOT SHOWN: DOOR CONTACT, CARD READER, ELECTRIC DOOR STRIKE AND REQUEST TO EXIT BUTTON (IF NO CRASHBAR IS PROVIDED.)
B.) ALL DEVICES SHALL INCLUDE 3/4"C W/PULLSTRING STUB-OUTS.
C.) FURNISH AND INSTALL ALL REQUIRED MATERIAL AND LABOR FOR A COMPLETE OPERABLE SYSTEM.



1 ACCESS CONTROL DOOR SCHEMATIC DIAGRAM

SCALE: NTS

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GENERAL NOTES:

1 PROVIDE #6AWG INSULATED GND FROM EACH (MDF/IDF)RACK TO ROOM GROUND BAR.

NETSHELTER CABINET 1

Data ports and Access Points

Provide PDU's connected to UPS System

RU45	Cable Organizer
RU44	
RU43	48-Port Patch Panel
RU42	
RU41	Cable Organizer
RU40	
RU39	48-Port Patch Panel
RU38	
RU37	Cable Organizer
RU36	
RU35	48-Port Patch Panel
RU34	
RU33	Cable Organizer
RU32	
RU31	48-Port Patch Panel
RU30	
RU29	Cable Organizer
RU28	
RU27	48-Port Patch Panel
RU26	
RU25	
RU24	* Repeat sequence as needed to
RU23	complete all required ports served by
RU22	this closet. Provide +15% ports for
RU21	future growth
RU20	
RU19	
RU18	
RU17	
RU16	
RU15	
RU14	
RU13	
RU12	
RU11	
RU10	
RU9	
RU8	
RU7	
RU6	
RU5	
RU4	
RU3	
RU2	
RU1	

NETSHELTER CABINET 2

Data ports and Access Points

Provide PDU's connected to UPS System

RU45	Fiber Enclosure
RU44	
RU43	
RU42	
RU41	Cable Organizer
RU40	
RU39	Fiber Optic Patch Panel
RU38	
RU37	Cable Organizer
RU36	
RU35	VOIP Switch
RU34	
RU33	Server
RU32	
RU31	KVM and NAS repository
RU30	
RU29	UPS
RU28	
RU27	
RU26	
RU25	
RU24	* Repeat sequence as needed to
RU23	complete all required ports served by
RU22	this closet. Provide +15% ports for
RU21	future growth
RU20	
RU19	
RU18	
RU17	
RU16	
RU15	
RU14	
RU13	
RU12	
RU11	
RU10	
RU9	
RU8	
RU7	
RU6	
RU5	
RU4	
RU3	
RU2	
RU1	

NOTE: CONTRACTOR SHALL BE RESPONSIBLE TO PROVIDE THE QUANTITIES REQUIRED FOR A COMPLETE OPERABLE SYSTEM.

NETWORK EQUIPMENT MANUFACTURERS AND MODELS.

C9200-48P-A Catalyst 9200 48-port PoE+, Network Advantage
CON-SNT-C920048P SNTC-8X5XNBD Catalyst 9200 48-port PoE+, Network Adva
CAB-TA-NA North America AC Type A Power Cable
C9200-DNA-A-48 C9200 Cisco DNA Advantage, 48-Port Term Licenses
C9200-DNA-A-48-3Y C9200 Cisco DNA Advantage, 48-Port, 3 Year Term License
C9200-STACK Catalyst 9200 Stack Module
PWR-C5-BLANK Config 5 Power Supply Blank
C9200-NM-4X Catalyst 9200 4 x 10G Network Module
PI-LFAS-T Prime Infrastructure Lifecycle & Assurance Term - Smart Lic
PI-LFAS-AP-T-3Y PI Dev Lic for Lifecycle & Assurance Term 3Y
C9200-STACK-KIT Cisco Catalyst 9200 Stack Module
NETWORK-PNP-LIC Network Plug-n-Play Connect for zero-touch device deployment
STACK-T4-50CM 50CM Type 4 Stacking Cable
C9200-NW-A-48 C9200 Network Advantage, 48-port license

4 POST RACK PANDUIT R4P6" W x 7' H Vertical Cable Manager
6" PANDUIT PR2VD06
INTELLIGENT 120VAC PLUG STRIP - VERTICALLY MOUNTED, output connectors: 48 (36 x IEC (30 AMP) PANDUIT P38D25M
INTELLIGENT 120VAC PLUG STRIP - VERTICALLY MOUNTED, output connectors: 48 (36 x IEC (20 AMP) PANDUIT P24D24M

Cable Runway 12" rung spacing CHATSWORTH 10250-712
Above rack waterfall Panduit R2PIPR2VWF
CABLE RUNWAY RADIUS DROP STRINGER CHATSWORTH 14304-712
L-BRACKET CHATSWORTH 11421-712
CABLE RUNWAY BUTT SPLICE KIT CHATSWORTH 11301-701
CABLE RUNWAY JUNCTION SPLICE KIT CHATSWORTH 11302-701
RACK TO RUNWAY MOUNTING KIT CHATSWORTH 10595-712
TRIANGULAR SUPPORT BRACKET, ALUMINUM CHATSWORTH 11312-712
WALL ANGLE SUPPORT KIT, CABLE RUNWAY CHATSWORTH 11421-712
Radius Drop - Cross Member CHATSWORTH 12100-712
Runway Elevation Kit CHATSWORTH 10506-706
Vertical Wall Bracket CHATSWORTH 10608-701
Cable Runway Ground Strap Kit CHATSWORTH 40164-001
Protective End Caps CHATSWORTH 10642-001

CATEGORY 6 UTP PLENUM CABLE BLUE TX 6000 (DATA,VOICE - MULTIMEDIA)
BLUE PANDUIT PUP6004BU-W
CATEGORY 6 JACK BLUE PANDUIT CJ688TGEI
8 INCH CATEGORY 6 PATCH CORDS PANDUIT UTPSP8INBUY
10 FOOT CATEGORY 6 PATCH CORDS PANDUIT UTP28SP10BU
DUAL PORT FACEPLATES PANDUIT CFPL6S-2GY
SIX PORT FACEPLATES PANDUIT CFPL6S-6GY
SINGLE PORT SURFACE MONUT BOXES PANDUIT CBX1BL-A
24-Port Category 6 Patch Panel Empty PANDUIT CPP24FMWBLY
48 PORT PATCH PANEL CATEGORY 6 Empty PANDUIT CPP48FMWBLY
FACEPLATE BLANKS PACKS OF TEN PANDUIT CMBWH-X

TYPICAL RACK LAYOUT ROOM MDF 139

MDF/IDF RACK DETAILS
SCALE: N.T.S

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AMERICAN INSTITUTE OF ARCHITECTS

REMOTE OPERATIONS CENTER
PRECINCT 1
THE COUNTY OF HIDALGO
708 E. EDINGBURG AVE.
ELSA, TX 78543

PROJECT NUMBER
224003

DATE
10-15-24

SHEET NUMBER
ET2.4

10-15-24

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MEP ENGINEERING
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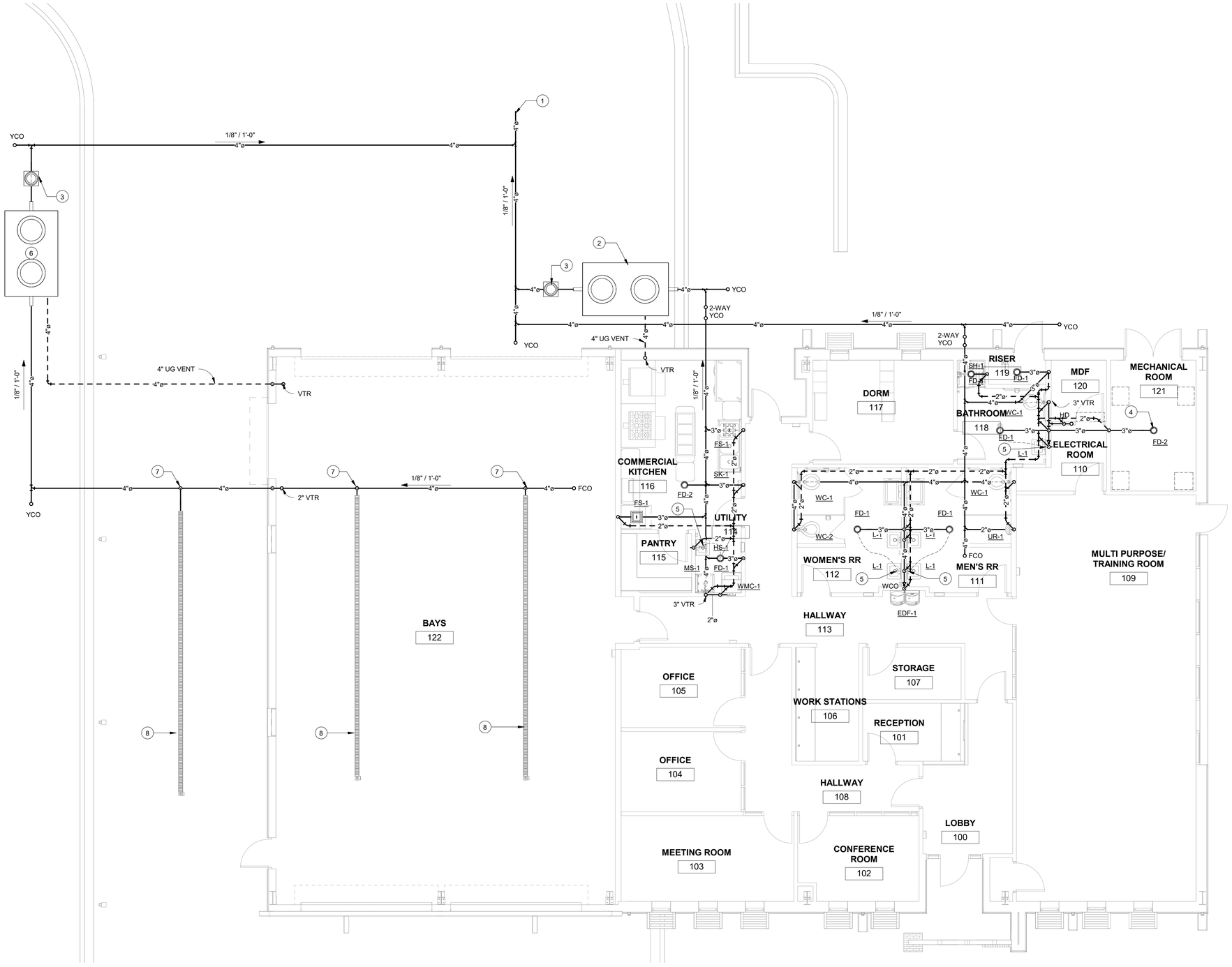
Project number: 24.2.29

STATE OF TEXAS
LEONARDO MUNOZ
97
REGISTERED ENGINEER



1 PLUMBING SEWER - FIRST FLOOR
3/16" = 1'-0"

PLUMBING KEYED NOTES	
1	REFER TO CIVIL SITE PLAN FOR CONTINUATION OF PLUMBING FIVE FEET AWAY FROM BUILDING. PLUMBING CONTRACTOR SHALL VERIFY LOCATIONS, INVERT SLOPE, ELEVATION, AND DIRECTION OF FLOW WITH CIVIL ENGINEERING DRAWINGS.
2	PROPOSED GREASE INTERCEPTOR LOCATION. PROVIDE GREASE INTERCEPTOR BY PARK USA MODEL#GT-1000. REFER TO DETAIL 02/P4.2. LOCATE BEYOND SIDEWALK.
3	PROVIDE SAMPLE WELL BY PARK USA MODEL #SWB-154. AT THIS APPROXIMATE LOCATION. FIELD COORDINATE EXACT LOCATION. REFER TO DETAIL 02/P4.2.
4	FLOOR DRAIN FOR CONDENSATE FROM AHU's. COORDINATE LOCATION WITH HVAC CONTRACTOR.
5	1/2" COPPER FROM TRAP PRIMER PROVIDE LAVATORY WITH "PRIME-EZE" TRAP PRIMER BY JR SMITH. REFER TO DETAIL 08/PD01. COVER WITH SLEEVE "POLY SLEEVE" OR EQUAL. TYPICAL ALL TRAP-PRIMERS.
6	PROVIDE 1000 GALLON SAND-OIL INTERCEPTOR EQUAL TO A PARK EQUIPMENT MODEL "SOCMP-1000" INSTALLATION SHALL MEET CITY REQUIREMENTS.
7	INSTALL 4" P-TRAP.
8	30 FOOT PRE SLOPED (ZURN) Z874-12 HEAVY DUTY FRAME TRENCH DRAIN BY PLUMBING CONTRACTOR.

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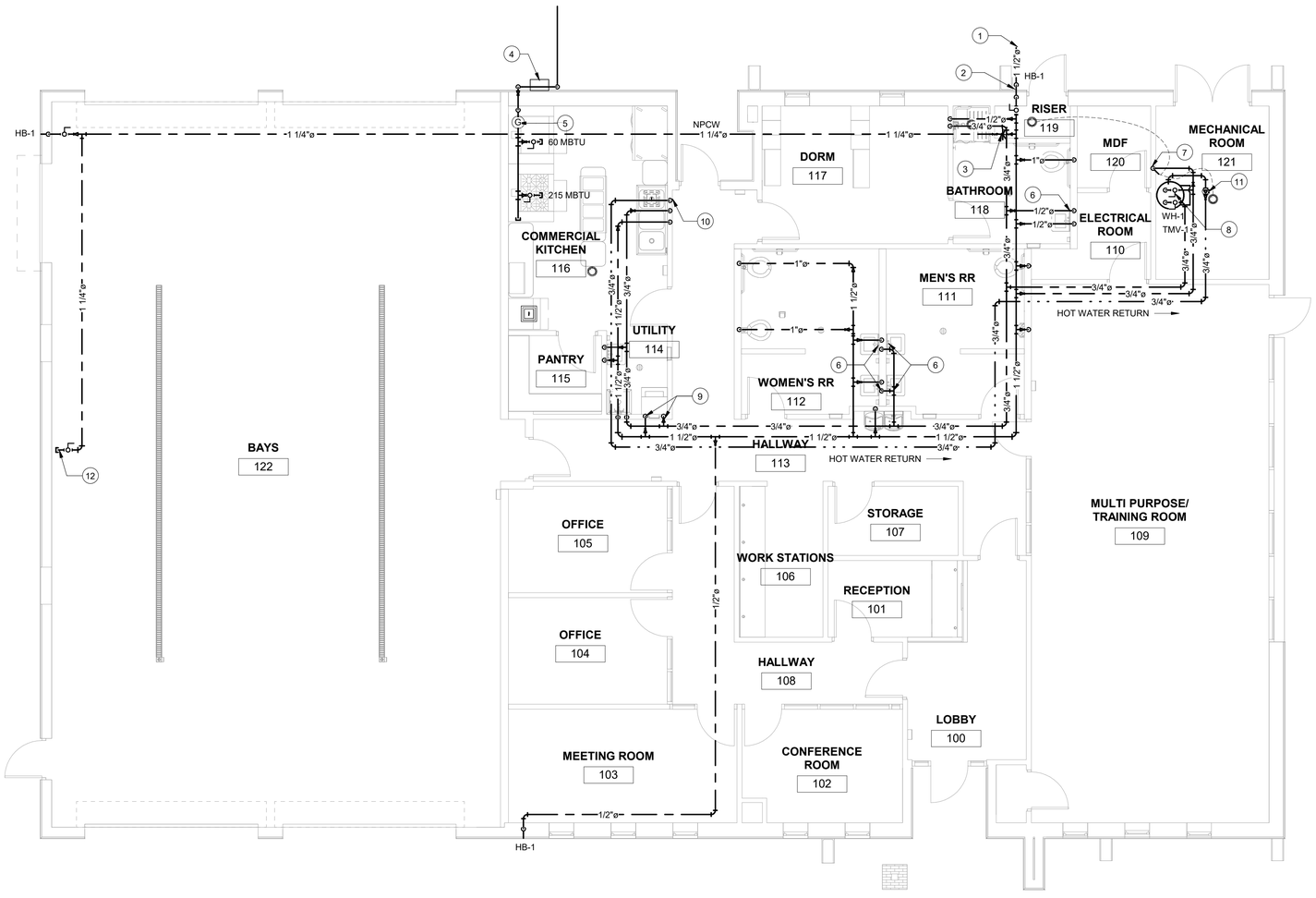
STATE OF TEXAS
LEONARDO MUNOZ
97147
LICENSED PROFESSIONAL ENGINEER



1 PLUMBING DOMESTIC WATER & NATURAL GAS- FIRST FLOOR
3/16" = 1'-0"

PLUMBING KEYED NOTES	
1	REFER TO CIVIL SITE PLAN FOR CONTINUATION OF DOMESTIC WATER PIPE.
2	WATER SERVICE ENTRANCE. REFER TO DETAIL 01/P4.1.
3	1-1/2" REDUCE PRESSURE ZONED BACKFLOW PREVENTER EQUAL TO WATTS 009QT WITH ISOLATION VALVES. 1-1/2" NON-POTABLE COLD WATER (NPCW) UP TO ABOVE CEILING TO SERVE SHOP.
4	NATURAL GAS METER, UNDERGROUND GAS SERVICE LINE, AND GAS SERVICE REGULATOR BY LOCAL GAS COMPANY. SITE FIELD VERIFY EXACT LOCATION, COORDINATE INSTALLATION AND PAY ALL ASSOCIATED FEES. EXTEND 1-1/2" LOW PRESSURE GAS UP EXTERIOR WALL TO ABOVE CEILING AND INTO BUILDING.
5	AUTOMATIC GAS VALVE EXPOSED 6" BELOW CEILING HEIGHT. FURNISHED WITH EXHAUST HOOD SUPPRESSION SYSTEM PACKAGE AND INSTALLED BY PLUMBING CONTRACTOR. INTERLOCK WITH HOOD SUPPRESSION SYSTEM. PROVIDE UNION ON INLET AND OUTLET.
6	PROVIDE THERMOSTATIC MIXING VALVE EQUAL TO WATTS LFMMV-US-M1, TO SERVE LAVATORY/LAVATORIES. SET TEMPERATURE PER LOCAL JURISDICTION REQUIREMENTS.
7	PRESSURE DROP ACTIVATED TRAP PRIMER. PROVIDE ACCESS PANEL IF INACCESSIBLE. SEE DETAIL 07/P4.1.
8	BRONZE CUT-OFF VALVE ABOVE CEILING. PROVIDE ACCESS PANEL WHERE LOCATED IN AN INACCESSIBLE CEILING. PANEL SHALL BE 12"X12" PAINTED TO MATCH CEILING.
9	WATER HAMMER ARRESTOR ABOVE CEILING. PROVIDE ACCESS PANEL WHERE LOCATED IN AN INACCESSIBLE CEILING. PANEL SHALL BE 12"x12" PAINTED TO MATCH CEILING.
10	ROUTE RECIRCULATED HOT WATER LINE DOWN WALL. ROUTE MAXIMUM 2' LONG 1/2" BRANCH TO HOT WATER CONNECTION OF LAVATORY. CONTINUE RECIRCULATED HOT WATER LINE BACK UP WALL.
11	HOT WATER RECIRCULATING PUMP.
12	3/4" NPCW TO CARWASH. COORDINATE EXACT POINT OF CONNECTION WITH CAR WASH SUPPLIER. INSTALL SHUT-OFF VALVE.

GAS LOAD SUMMARY

DESCRIPTION	GAS LOAD (BTUH)
GAS STOVE GRIDDLE	215,000 60,000
TOTAL GAS LOAD	275,000 BTUH @ 7.5" W.C. DELIVERY PRESSURE

10-15-24

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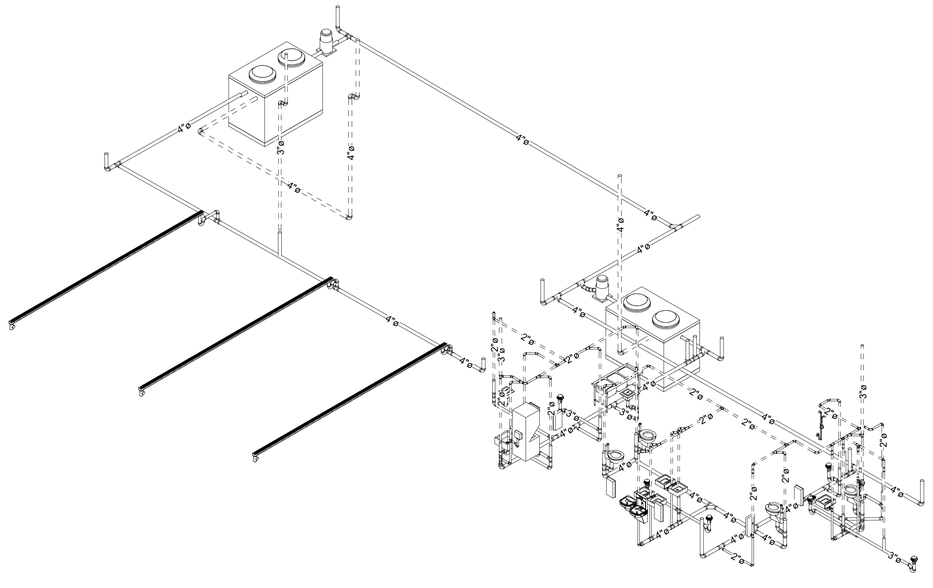
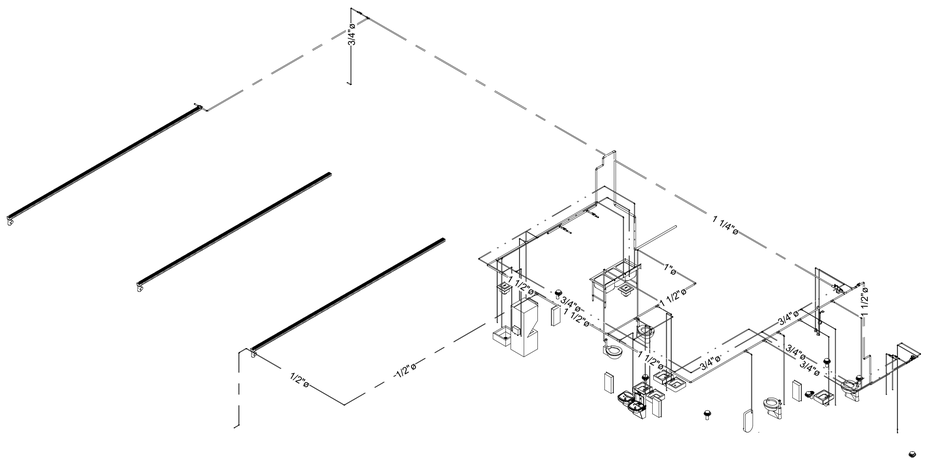


1 PLUMBING SEWER & VENT RISER



2 PLUMBING DOMESTIC WATER & NATURAL GAS RISER

10-15-24

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ABBREV. / DESCRIPTION

ABBREV.	DESCRIPTION
AC	ABOVE CEILING
AFF	ABOVE FINISHED FLOOR
ASA	AMERICAN STANDARDS ASSOCIATION
ASME	AMERICAN SOICIETY OF MECHANICAL ENGINEERS
ASTM	AMERICAN SOCIETY FOR TESTING MATERIALS
AW	ACID WASTE
AWWA	AMERICAN WATER WORKS ASSOCIATION
AV	ACID VENT
BTUH	BRITISH THERMAL UNIT PER HOUR
CA	COMPRESSED AIR
CI	CAST IRON
CO	CLEANOUT
CU	COPPER
DN	DOWN
EQ	EQUAL
FCO	FLOOR CLEANOUT
FF	FINISH FLOOR
FG	FINISH GRADE
FH	FIRE HYDRANT
GAL	GALLON(S)
GALV	GALVANIZED
GW	GREASE WASTE
HB	HOSE BIBB
HP	HORESPOWER
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
OC	ON CENTER
RD	ROOF DRAIN(S)
RE:#/P6	REFER TO DETAIL 4 DRAWING P-6
RO	REVERSE OSMOSIS
SD	STORM DRAIN
SPEC	SPECIFICATION
TYP	TYPICAL
UG	UNDERGROUND
UL	UNDERWRITERS LABORATORIES
VTR	VENT THRU ROOF
V	VACUUM
W/	WITH
WCO	WALL CLEAN OUT
YCO	YARD CLEAN OUT

PLUMBING GENERAL NOTES: (ALL SHEETS)

A. ALL WORK AND MATERIAL SHALL BE IN COMPLIANCE WITH ALL APPLICABLE CODES AS ADAPTED AND AMENDED BY THE INSPECTING AUTHORITIES.

B. ALL PLUMBING WORK SHALL BE INSTALLED SO AS TO AVOID CONFLICT WITH ALL ELECTRICAL WORK, MECH'L WORK AND STRUCTURAL MEMBERS. COORDINATE WITH MECHANICAL, ELEC'L AND STRUCTURAL FOR PROPER CLEARANCES.

C. REFER TO ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR PHASING AND SEQUENCE OF CONSTRUCTION OF WORK.

D. SLEEVE ALL OUTSIDE WALL, FLOOR SLAB, AND GRADE BEAM PENETRATIONS PER DETAILS AND PER CODE.

E. LOCATE ALL PLUMBING VENTS TO ROOF (VTR) SO THAT THEY TERMINATE A MINIMUM OF 1'-0" AWAY FROM ANY VERTICAL SURFACE AND 10'-0" AWAY FROM ANY OUTSIDE AIR INTAKES.

F. RECORD INVERT ELEVATIONS OF ALL YCO'S ON "AS-BUILT" DRAWINGS.

G. MINIMUM 3" WASTE LINE BELOW FLOOR AND MINIMUM 2" WASTE RISER. UNLESS NOTED OTHERWISE (UNO).

H. PLUMBING CONTRACTOR SHALL PAY FOR ALL UTILITY CONNECTIONS FEES, PERMITS, TESTS AND INSPECTIONS. FURNISH 3 COPIES OF INSPECTION CERTIFICATE BEFORE REQUESTING FINAL PAYMENT.

I. PLUMBING CONTRACTOR SHALL BE RESPONSIBLE FOR PATCHING AND REPAIRING ALL AREAS WHICH ARE DAMAGED BY HIS OPERATIONS.

J. CUTTING OF CONCRETE FLOORS SHALL BE BY MACHINE SAW. HOLES FOR PIPES (WALL OR FLOOR) SHALL BE DONE WITH CORE DRILLING EQUIPMENT WITH PRIOR APPROVAL FROM THE STRUCTURAL ENGINEERS.

K. PRESSURE TEST ALL INSTALLATIONS PRIOR TO CONNECTING EQUIPMENTS.

L. LABEL ALL PIPING PER ANSI STANDARD.

M. PROVIDE PROPER INSULATION ON ALL HOT WATER PIPING, STORM PIPING AND CONDENSATE PIPING.

N. PROVIDE SHUT-OFF VALVES (STOPS) ON ALL ROUGH-INS TO FIXTURES AND EQUIPMENTS.

O. PROVIDE ANY BACK FLOW PREVENTION DEVICE REQUIRED BY CODE OR GOVERNING AUTHORITIES, CONTRACTOR SHALL VERIFY THIS WITH CITY OR LOCAL AGENCIES AND INCLUDE COST OF SAME IN BID. CONTRACTOR TO HAVE BACK FLOWS CERTIFIED.

P. PROVIDE WATER HAMMER ARRESTORS AS INDICATED ON THE DRAWINGS. AIR CHAMBERS NOT AN APPROVED SUBSTITUTE.

Q. ALL EXPOSED PIPING FOR DESIGNATED DISABLED ACCESS FIXTURES SHALL BE COVERED OR OTHERWISE WRAPPED IN ACCORDANCE WITH A.D.A. REQUIREMENTS AND LOCAL AUTHORITY.

R. ALTERNATE MATERIALS NOT IDENTIFIED IN SPECIFICATIONS/DRAWINGS BUT APPROVED BY LOCAL AUTHORITY SHALL BE SUBMITTED TO ARCHITECT AND PLUMBING ENGINEER FOR REVIEW PRIOR TO INSTALLATION.

S. ISOMETRIC DIAGRAMS ARE FOR SIZING PURPOSES ONLY AND SHALL NOT BE USED FOR MATERIAL TAKE-OFFS, OR BE CONSTRUED TO INDICATE ACTUAL SITE INSTALLATION.

T. DRAWING IS DIAGRAMMATIC ONLY. CONTRACTOR SHALL COORDINATE EXACT LOCATIONS OF PIPING, DEVICES AND EQUIPMENT WITH BUILDING ELEMENTS AND THE WORK OF OTHER TRADES.

U. EVERY FLOOR DRAIN, FLOOR SINK OR HUB DRAIN SHALL BE SERVED BY AN AUTOMAITC TRAP PRIMER, UNO.

PLUMBING SYMBOL LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	BALL VALVE		DOMESTIC COLD WATER
	CHECK VALVE		DOMESTIC HOT WATER
	GATE VALVE		DOMESTIC HOT WATER RETURN
	UNION		SANITARY SEWER VENT
	DIRECTION OF FLOW		SANITARY WASTE LINE
	WALL CLEANOUT	140°	140° HOT WATER
	FLOOR CLEANOUT YARD CLEANOUT		SANITARY DIRECTION OF FLOW
	FLOOR SINK		BRANCH - TOP CONNECTION
	FLOOR DRAIN		PIPE RISER
	WALL HYDRANT OR HOSE BIBB		PIPE DROP
			POINT OF CONNECTION (APPROXIMATED FIELD VERIFY EXACT POINT OF CONNECTION)

NOTE: 1. NOT ALL SYMBOLS USED ON THIS PROJECT
2. INSTALL WATER CLOSET FLUSH VALVE HANDLE TOWARDS WIDER SIDE OF WATER CLOSET OR DOOR OPENING.
3. INSTALL ADA APPROVED FLUSH VALVE HANDLE FOR ADA PLUMBING FIXTURES.

PLUMBING PIPING MATERIAL:

1. SANITARY DRAIN & VENT INSIDE BUILDING BELOW GRADE: SCHEDULE 40 PVC
2. SANITARY DRAIN OUTSIDE BUILDING: SCHEDULE 40 PVC
3. SANITARY DRAIN & VENT INSIDE BUILDING ABOVE GRADE: SCHEDULE 40 PVC
4. SANITARY DRAIN & VENT IN PLENUM CEILING: NO-HUB CAST IRON
5. ACID WASTE PIPING: FR POLYPROPYLENE
6. ACID VENT IN PLENUM CEILING: FR-PVDF
7. DOMESTIC HOT & COLD WATER: COPPER, TYPE "L" HARD DRAWN
8. DOMESTIC WATER BELOW GRADE: COPPER, TYPE "K" SOFT ANNEALED
8. DOMESTIC WATER BELOW GROUND OUTSIDE OF BUILDING PIPING 2" SIZE AND SMALLER: COPPER, TYPE "L" HARD DRAWN
9. DOMESTIC WATER BELOW GROUND OUTSIDE OF BUILDING PIPING OVER 2" SIZE: SDR 26 CLASS 160 PVC

APPLICABLE BUILDING CODE

2018 International Building Code
2018 International Plumbing Electrical Code
2018 International Mechanical Code
2018 International Energy Conservation Code
2018 International Existing Building Code
2017 National Electrical Code of the National Fire Protection Association
2018 International Fire Code
2012 Texas Accessibility Standards

ELECTRIC WATER HEATER SCHEDULE

DESIG.	STORAGE GALLONS	RECOVERY G.P.H.	DEGREE RISE °F	WATER TEMP. LEAVING	WATER INLET	WATER OUTLET	REMARKS
WH-1	119	68	60°	120°	3/4"	3/4"	RHEEM MODEL NO. ELD120-TB, 12.1KW, 208V/3□, ELECTRIC TANK TYPE. PROVIDE 5 GALLON EXPANSION TANK. PROVIDE 4 INCH CONCRETE PAD.

RECIRCULATING PUMP SCHEDULE

MARK	GPM	FEET HEAD	POWER	RPM	VOLTS/PHASE	REMARKS
CP-1	0-11	0-13	44W	3250	120 volts/1□	EQUAL TO TACO MODEL 006E3LC, COMPSOTE CASING, WET ROTOR CIRCULATOR, MAINTENANCE FREE, WET-ROTOR, IN-LINE, 3SETTING SPEED DIAL. PROVIDE WITH GRUNDFOS AQUASTAT TIMER AND THERMOSTATIC CONTROL KIT

PLUMBING FIXTURE SCHEDULE

MARK	FIXTURE TYPE	CONNECTION SIZE				DESCRIPTION
		San. Sewer	Vent	Cold Water	Hot Water	
WC-1	WATER CLOSET FLOOR MOUNTED ADA	4"	2"	1"	-	KOHLER "HIGHCLIFF ULTRA" MODEL NO. K-96057 , FLOOR MOUNTED WATER CLOSET, WITH ELONGATED RIM, 16-5/8" RIM HEIGHT, VITREOUS CHINA, SIPHON JET FLUSH ACTION 10"- 12" ROUGH IN, WITH SLOAN "ROYAL" MANUAL FLUSHOMETER VALVE MODEL NUMBER 111-1.28 , FLOW RATE (1.28 GPF), INCLUDES 1" TOP SPUD AND 2 BOLTS CAPS. COMPLETE WITH BEMIS MODEL NO. 1955SSTFR, OPEN FRONT SEAT LESS COVER. FLUSH LEVER SHALL BE MOUNTED ON APPROACH SIDE OF FIXTURE.
WC-2	WATER CLOSET FLOOR MOUNTED	4"	2"	1"	-	KOHLER "WELLCOMME ULTRA" MODLE NO. K-96053 , LOW CONSUMPTION (1.6GPF) FLOOR MOUNTED WATER CLOSET, ELONGATED RIM, 15-3/16" RIM HEIGHT, VITREOUS CHINA (WHITE), 1 1/2" TOP SPUD, SIPHON JET ACTION, WITH SLOAN "ROYAL" MANUAL FLUSHOMETER VALVE MODEL NUMBER 111-1.28 , FLOW RATE (1.28 GPF), INCLUDES 1" TOP SPUD AND 2 BOLTS CAPS. COMPLETE WITH BEMIS MODEL NO. 1955SSTFR, OPEN FRONT SEAT LESS COVER, FLUSH LEVER SHALL BE MOUNTED ON APPROACH SIDE OF FIXTURE.
UR-1	URINAL (STANDARD & HANDICAPPED) REFER TO ARCH'L DRAWING FOR MOUNTING HEIGHTS	2"	2"	3/4"	-	KOHLER "DEXTER" MODEL NO. K-5016-ER, SIPHON JET WALL HUNG URINAL. VITREOUS CHINA, 1 GPF FLUSH OR LESS, COMPACT DESIGN, WITH INTEGRAL TRAP, 3/4" TOP INLET, 14" LIP, INCLUDES WALL HANGERS, 2" IPS OUTLET FLANGE AND RUBBER GASKET. WITH SLOAN "ROYAL" MANUAL URINAL FLUSHOMETER VALVE MODEL NUMBER 186-0.5 , FLOW RATE (0.5 GPF). INCLUDES 3/4" TOP SPUD AND 2 BOLTS CAPS. . SF PROVIDE ZURN CARRIER SYSTEM MODEL NO. Z-1221.
L-1	LAVATORY WALL HUNG ADA REFER TO ARCH'L DRAWING FOR MOUNTING HEIGHTS	2"	2"	1/2"	1/2"	KHOLAR "BRENHAM" MODEL NO. K-1997-4 (21x19) WALL HUNG LAVATORY, WITH OVERFLOW. INCLUDES WALL HANGER, VITREOUS CHINA, WITH 4-INCH CENTER FAUCET HOLES. PROVIDE FAUCET EQUAL TO MOEN MODEL 8413F05, SINGLE HANDLE, FLOW RATE (0.5 GPM) . VANDAL RESISTANT, ADA APPROVED. PROVIDE ANTI-ROTATION DECKPLATE MODEL NO. 9955O. PROVIDE PROTECTIVE COVER SHIELD ZURN AQUASPEC PART MODEL NO. Z6900-VG ON P-TRAP AND STOPS. PROVIDE ZURN CARRIER SYSTEM MODEL: Z1231 PROVIDE P-TRAP: 17 GAUGE CHROME DEARBORN BRAND PROVIDE SINK/LAV WITH SINGLE OUTLET THERMOSTATIC MIXING VALVE (TMV), WATTS LFMMV-US-M1, SET TEMPERATURE AS PER LOCAL JURISDICTION.
SK-1	THREE-COMPARTMENT SINK	2"	2"	1/2"	1/2"	AERO F3 SERIES MODEL NO. MF3-2418 18-GAUGE, FULLY UNDERCOATED,304 STAINLESS STEEL, THREE-BOWL, TWO FAUCET HOLE, CENTER DRAIN, 3-1/2-INCH OUTLET, FAUCET: AERO MODEL S-6, LEDGE MOUNTED, TWO WRIST BLADE HANDLES, 14-INCH SPOUT, SUPPLY: MCGUIRE 2167 SERIES. TRAP: MCGUIRE 8912 SERIES. STRAINER AND TAILPIECE: MCGUIRE 151 SERIES, BASKET TYPE.
MS-1	MOP SINK	3"	2"	1/2"	1/2"	FIAT MODEL NO. TSB100, 24"X24"X12" TERRAZO MOP SINK, COMPLETE WITH FAUCET MODEL 830-AA. MOP SINK SHALL INCLUDE ALL HOSE BRACKETS, HOSE, AND MOP HANGER, WITH 3" DRAIN WITH STRAINER & DEEP SEAL P-TRAP. PROVIDE WALL GUARD MSG2424.
EDF-1	ELECTRIC WATER COOLER W/ Water Refilling Station REFER TO ARCH'L DRAWING FOR MOUNTING HEIGHTS	2"	2"	1/2"	-	Bi-LEVEL ELECTRIC WATER COOLER SHALL BE "ELKAY" MODEL No. LZSTL8WSVRSK, WITH Elkay EZH2O Water Refilling Station, CAPACITY OF 8.0 GALLONS, STAINLESS STEEL BASIN WITH INTEGRAL DRAIN GRID AND EMBOSSED BUBBLER PAD, LEAD FREE ADA COMPLIANT, WITH ZURN CARRIER MODEL No. Z-1225, WITH APRON MODEL NO. LKAPR-EZL TO COMPLY WITH TAS AND ADA.
SH-1	SURFACE-MOUNTED BARRIER-FREE WALL SHOWER	2"	2"	1/2"	1/2"	SHOWER SYSTEM EQUAL TO BRADLEY MODEL NO. HN250-TMV-SX15-AKV-RSD-VS SURFACE-MOUNTED BARRIER FREE SHOWER UNIT. INCLUDES FIXED DIRECTION ADJUSTABLE SPRAYHEAD, DIVERTER VALVE, HAND-HELD SHOWER SPRAY, 2.0 GPM FLOW CONTROL, L-SHAPED GRAB BAR, BARRIER-FREE SEAT, SHOWER CURTAIN, ROD AND HOOKS. PROVIDE WITH OPTIONS: TMV (THERMOSTATIC MIXING VALVE), SX (SEVERE SERVICE SHOWERHEAD), AKV (ALLEN KEY VOLUME CONTROL), RSD (RECESSED SOAP DISH). PROVIDE SHOWER W/ FLOOR DRAIN EQUAL TO JOSAM PART # 30002-6A-Y-50, CAST IRON BODY WITH CLAMP RING, FLANGE, ADJUSTABLE NIKALOY STRAINER, HUB OUTLET WITH GASKET.
IMC	ICE MAKER CONNECTION BOX	-	-	1/2"	-	CONNECTION BOX EQUAL TO GUY GRAY NO. BIM875 PREFABRICATED RECESSED BOX WITH COMPRESSION ANGLE VALVE.
HB-1	HOSE BIB EXTERIOR GENERAL USE	-	-	3/4"	-	MILD TEMPERATURE WALL HYDRANT SHALL BE WADE MODEL 8600MT-175 3/4" INLET WITH BRONZE CASING, BRONZE FACE AND STRAIGHT INLET CONNECTION WITH INTEGRAL BACKFLOW PREVENTER.
TMV-1	THERMOSTATIC MIXING VALVE	-	-	3/4"	3/4"	BRADLEY THERMOSTATIC MIXING VALVE MODEL S59-2025-TMV25 SURFACE. PROVIDE WITH CABINET TO BE EQUAL TO BRADLEY CABINET MODEL CAB-TMV25-R-S-T-P-SS-W SURFACE MOUNT STAINLESS STEEL CABINET.
HS-1	HAND SINK	2"	2"	1/2"	1/2"	EAGLE GROUP MODEL NO. HSA-10-FWLDP-LRS WITH FAUCET W/WRIST HANDLES ASSEMBLY,PAPER TOWEL AND SOAP DISPENSER.
WMC-1	WASHING MACHINE CONNECTION BOX	2"	2"	1/2"	1/2"	CONNECTION BOX EQUAL TO GUY GRAY NO. B200.
FD-1	RESTROOM FLOOR DRAIN	AS NOTED ON PLANS				EQUAL TO JOSAM PART # 30003-6A-Y-50, CAST IRON BODY WITH CLAMP RING, FLANGE, ADJUSTABLE NIKALOY STRAINER, HUB OUTLET WITH GASKET AND 1/2" PRIMER TAP.
FD-2	FLOOR DRAIN	AS NOTED ON PLANS				EQUAL TO JOSAM PART # 30003-7E2-Y, COATED CAST IRON BODY WITH CLAMP RING, TWO PIECE BODY WITH DOUBLE DRAINAGE FLANGE, ADJUSTABLE NIKALOY FUNNEL STRAINER .
FS-1	DISHWASH/PREP. SINK FLOOR SINK	AS NOTED ON PLANS				EQUAL TO JOSAM PART # 49364A-4-31-Z-SSLF, 12" SQUARE A.R.E. TOP, WITH 9-7/8" DEEP SUMP STAINLESS STEEL FLOOR SINK LESS FLANGE, 3/4 GRATE, ALUMINUM SEDIMENT BUCKET.
FCO	FLOOR CLEANOUT	AS NOTED ON PLANS				MIFAB MODEL "C1100-R-1" ADJUSTABLE FLOOR CLEANOUT, COMPLETE WITH NICKEL BRONZE TOP ASSEMBLY, LACQUERED CAST IRON FLOOR DRAIN WITH ANCHOR FLANGE, AND PRIMARY GASKET SEAL.
YCO	YARD CLEANOUT	AS NOTED ON PLANS				MIFAB MODEL "C-1220" LACQUERED CAST IRON CLEANOUT, THREADED BRONZE PLUG FOR AIR TIGHT SEAL AND STANDARD REINFORCED SATIN FINISHED NICKEL BRONZE ADJUSTABLE TOP ASSEMBLY.
WCO	WALL CLEANOUT	AS NOTED ON PLANS				MIFAB MODEL "C1430-RD" CAST BRONZE CLEANOUT PLUG. COMPLETE WITH STAINLESS STEEL WALL ACCESS COVER AND ANCHOR SCREW. MOUNT 24" A.F.F.

NOTES:

1.) INSULATE ALL WATER AND WASTE PIPING UNDER LAVATORIES WITH HANDY-SHIELD JACKET BY PLUMBEREX.

2.) PROVIDE SINGLE FIXTURE WATER HAMMER ARRESTORS EQUAL TO MINI-RESTER , HYDRA-RESTER SIOUX CHIEF, FOR ALL PLUMBING FIXTURES IN THE WATER SUPPLY SYSTEM.

3.) ALL VITREOUS CHINA FIXTURES SHALL BE WHITE.

10-15-24

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AMERICAN INSTITUTE OF ARCHITECTS

REMOTE OPERATIONS CENTER
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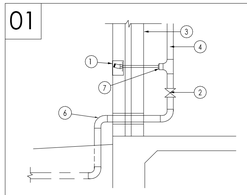
THE COUNTY OF HIDALGO
708 E. EDINGBURG AVE.
ELSA, TX 78543

PROJECT NUMBER
224003

DATE
10-15-24

SHEET NUMBER
P3.1

01

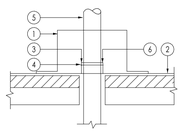


1. WALL HYDRANT - INSTALL LOW ENOUGH TO DRAIN RISER.
2. MAIN SHUT-OFF VALVE
3. WALL
4. TYPE "L" COPPER, WATER SUPPLY TO SYSTEM
5. SLEEVE
6. PROVIDE 1" ARMAFLEX INSULATION W/ METAL JACKET ON EXPOSED PIPING.
7. REDUCE PIPE ACCORDINGLY FOR SUPPLY TO HOSE BIBB

WATER SERVICE ENTRANCE DETAIL

NO SCALE

05

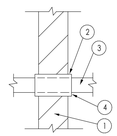


1. PREFABRICATED ROOF CURB, FURNISHED & INSTALLED BY ROOFING CONTR. (COORDINATE)
2. METAL ROOFING
3. STAINLESS STEEL CLAMP
4. SLEEVE PIPE BY ROOFING CONTR.
5. VTR - USE CAST IRON WHERE CEILING IS PLENUM SPACE.
6. PROVIDE CAULKING GROVE
7. LOCATE MIN. 10'-0" FROM A/C AIR INTAKES

VENT THRU ROOF DETAIL

NO SCALE

09

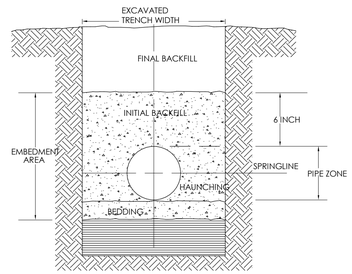


1. MASONRY WALL
2. GALVANIZED SCHEDULE 40 STEEL OR COPPER SLEEVE, SIZE TO BE MINIMUM 3/8" LARGER IN DIAMETER THAN PIPE AND INSULATION.
3. PLUMBING PIPE (RELIER LINES, DOMESTIC WATER, AIR, AND GAS PIPING).
4. FILL VOID WITH MINERAL WOOL AND CAULK VERMIN TIGHT.

WALL SLEEVE DETAIL

NO SCALE

13



UNDERGROUND INSTALLATION OF PLASTIC PIPE

PLASTIC PIPE SHOULD ALWAYS BE BURIED IN STRICT ACCORDANCE WITH THE ASTM STANDARD RELEVANT TO
THE TYPE OF PLASTIC PIPING SYSTEM BEING INSTALLED. THOSE STANDARDS ARE:

ASTM D2321 STANDARD PRACTICE FOR UNDERGROUND INSTALLATION OF THERMOPLASTIC PIPE FOR SEWERS AND OTHER GRAVITY-FLOW APPLICATIONS.

ASTM D2774 STANDARD PRACTICE FOR UNDERGROUND INSTALLATION OF THERMOPLASTIC PRESSURE PIPING.

NOTE: IN ADDITION TO THESE STANDARDS, PIPE SHOULD ALWAYS BE INSTALLED IN ACCORDANCE WITH ALL LOCAL CODE REQUIREMENTS.

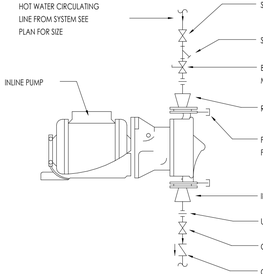
RECOMMENDATIONS FOR UNDERGROUND INSTALLATION OF PLASTIC DRAINAGE PIPE:

1. THE MINIMUM WIDTH OF THE TRENCH SHOULD BE THE PIPE OD (OUTSIDE DIAMETER) PLUS 16 INCHES OR THE PIPE OUTSIDE DIAMETER TIMES 1.25 PLUS 12 INCHES. THIS WILL ALLOW ADEQUATE ROOM FOR JOINING THE PIPE. SNAKING THE PIPE IN THE TRENCH TO ALLOW FOR EXPANSION AND CONTRACTION WHERE APPROPRIATE AND SPACE FOR BACKFILLING AND COMPACTION OF BACKFILL. THE SPACE BETWEEN THE PIPE AND TRENCH WALL MUST BE WIDER THAN THE COMPACTION EQUIPMENT USED TO COMPACT THE BACKFILL.
2. PROVIDE A MINIMUM OF 4 INCHES OF FIRM, STABLE AND UNIFORM BEDDING MATERIAL IN THE TRENCH BOTTOM. IF ROCK OR UNYIELDING MATERIAL IS ENCOUNTERED, A MINIMUM OF 6 INCHES OF BEDDING SHALL BE USED. BLOCKING SHOULD NOT BE USED TO CHANGE PIPE GRADE OR TO INTERMITTENTLY SUPPORT PIPE OVER LOW SECTIONS IN THE TRENCH.
3. THE PIPE SHOULD BE SURROUNDED WITH AN AGGREGATE MATERIAL WHICH CAN BE EASILY WORKED AROUND THE SIDES OF THE PIPE. BACKFILLING SHOULD BE PERFORMED IN LAYERS OF 6 INCHES WITH EACH LAYER BEING SUFFICIENTLY COMPACTED TO 85% TO 95% COMPACTION.
4. A MECHANICAL TAMPER IS RECOMMENDED FOR COMPACTING SAND AND GRAVEL. THESE MATERIALS CONTAIN FINE-GRAINS, SUCH AS SILT AND CLAY. IF A TAMPER IS NOT AVAILABLE, COMPACTING SHOULD BE DONE BY HAND.
5. THE TRENCH SHOULD BE COMPLETELY FILLED. THE BACKFILL SHOULD BE PLACED AND SPREAD IN UNIFORM LAYERS TO PREVENT ANY UNFILLED SPACES OR VOIDS. LARGE ROCKS, STONES, FROZEN CLODS, OR OTHER LARGE DEBRIS SHOULD BE REMOVED. STONE BACKFILL SHALL PASS THROUGH AN 1-1/2" SIEVE. ROCK SIZE SHOULD BE ABOUTONE-TENTH OF THE PIPE OUTSIDE DIAMETER. HEAVY TAMPERS OR ROLLING EQUIPMENT SHOULD ONLY BE USED TO CONSOLIDATE THE FINAL BACKFILL.
6. TO PREVENT DAMAGE TO THE PIPE AND DISTURBANCE TO PIPE EMBEDMENT, A MINIMUM DEPTH OF BACKFILL ABOVE THE PIPE SHOULD BE MAINTAINED. PIPE SHOULD ALWAYS BE INSTALLED BELOW THE FROST LEVEL. TYPICALLY, IT IS NOT ADVISABLE TO ALLOW VEHICULAR TRAFFIC OR HEAVY CONSTRUCTION EQUIPMENT TO TRAVERSE THE PIPE TRENCH.

UNDERGROUND INSTALLATION DETAIL OF PLASTIC PIPING SYSTEMS

NO SCALE

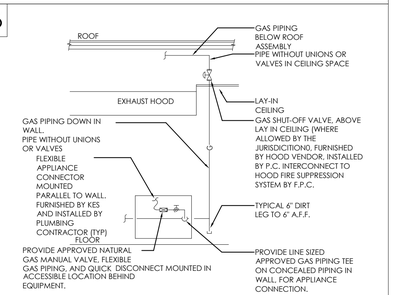
15



INLINE CIRCULATING PUMP DETAIL

NO SCALE

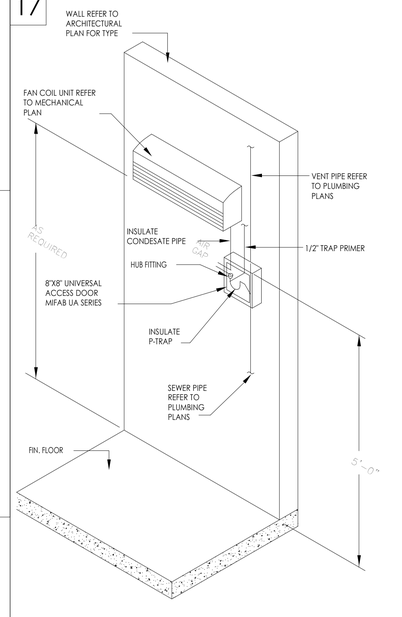
16



EQUIPMENT GAS CONNECTION DETAIL

NO SCALE

17



CONDENSATE DRAIN DETAIL

NO SCALE

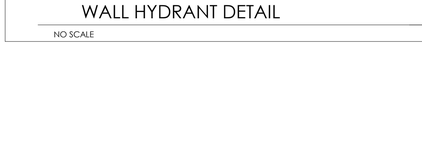
02

CLEAR TRENCH OF ALL ROCKS AND DEBRIS BEFORE ADDING SAND CUSHION.

COMPACT TRENCH FILL TO 95% PROCTOR DENSITY.

MAINTAIN A MINIMUM OF 60 INCHES UNDISTURBED EARTH BETWEEN PARALLEL WATER AND SEWER LINES OR SUPPORT WATER LINE ON SEPARATE SHELF A MINIMUM OF 12" ABOVE SEWER LINE.

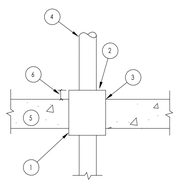
MAINTAIN A MINIMUM OF 24" HORIZONTALLY BETWEEN ELECTRICAL PRIMARY AND SEWER. MAINTAIN A MINIM OF 12" VERTICALLY OR 24" HORIZONTALLY BETWEEN ELECTRICAL PRIMARY AND WATER LINES, GAS LINES, TELEPHONE RACEWAYS AND CABLE RACEWAYS.



TRENCHING DETAIL

NO SCALE

06

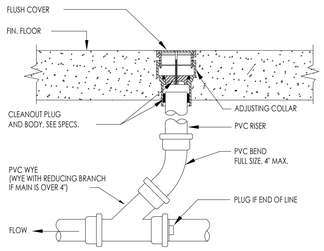


1. METAL SLEEVE TWO SIZES LARGER THAN PIPE
2. FILL VOID WITH NON-SHRINKING WATERPROOF, VERMIN PROOF MATERIAL
3. ALL PLUMBING PIPE PENETRATIONS THROUGH GROUND FLOOR, AND GRADE BEAMS SHALL BE SLEEVED
4. PIPE
5. CONCRETE SLAB
6. MINIMUM 2"

FLOOR PENETRATION DETAIL

NO SCALE

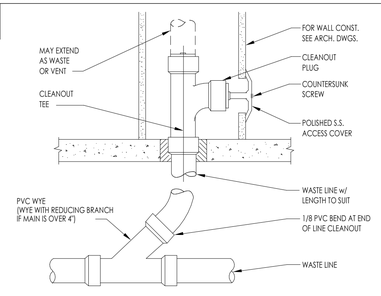
10



FLOOR CLEANOUT DETAIL

NO SCALE

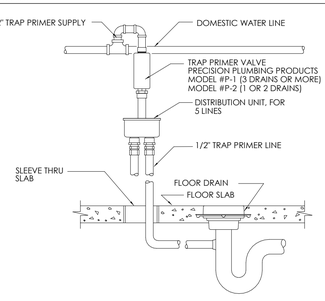
03



WALL CLEANOUT DETAIL

NO SCALE

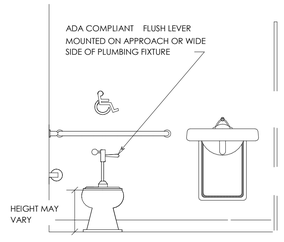
07



TRAP SEAL PRIMER DETAIL

NO SCALE

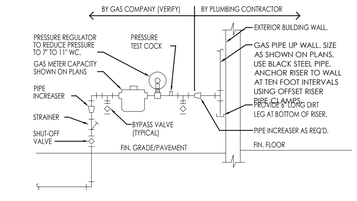
11



ADA WATER CLOSET DETAIL

NO SCALE

14

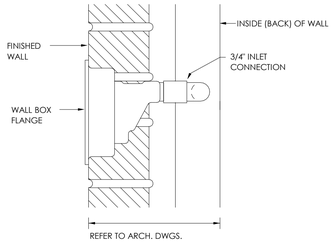


NOTE:
VERIFY REQUIREMENTS FOR METERING AND PIPING WITH GAS COMPANY. INSTALL OTHER UTILITIES A MINIMUM OF 10'-0" FROM GAS LINE. PLUMBING CONTRACTOR SHALL PAY ALL GAS COMPANY FEES FOR INSTALLATION. USE WELDED OR SCREWED PIPE AND FITTINGS PER PLUMBING SPECS. GAS COMPANY SHALL EXCAVATE, BACKFILL AND REPAIR ANY PAVING OR SOD FOR GAS SERVICE LINE INSTALLATION FROM MAIN TO BUILDING.

GAS SERVICE DETAIL

NO SCALE

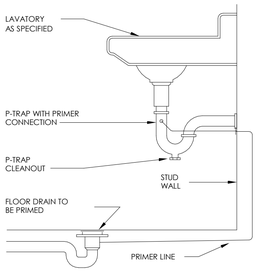
04



WALL HYDRANT DETAIL

NO SCALE

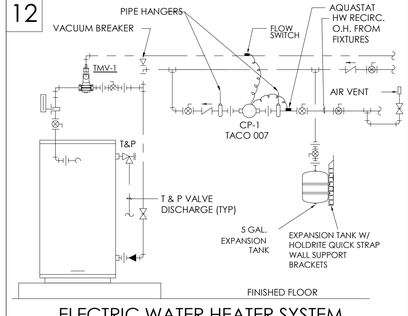
08



TRAP SEAL PRIMER INSTALLATION DETAIL

NO SCALE

12



ELECTRIC WATER HEATER SYSTEM

NO SCALE

MILNET ARCHITECTURAL SERVICES

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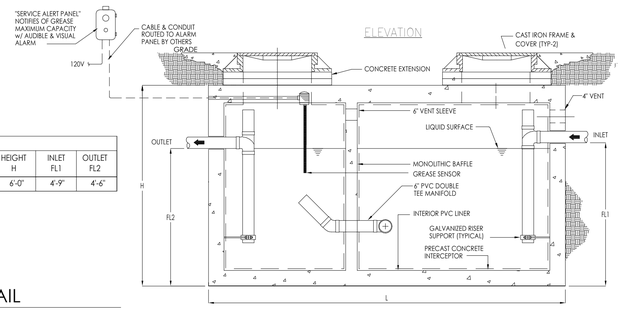


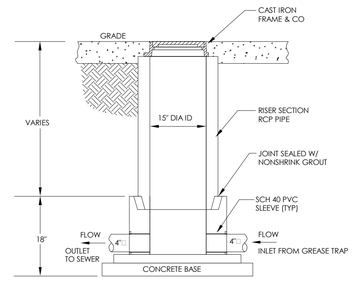
GREASE INTERCEPTOR SCHEDULE								
MODEL NO.	CAPACITY USGal	GREASE CAP. (LBS)	EMPTY WT (LBS)	LENGTH L	WIDTH W	HEIGHT H	INLET FL1	OUTLET FL2
GT-1000	1000	2,300	13,350	8'-8"	5'-0"	6'-0"	4'-9"	4'-6"

SIZE AND DESIGN SUBJECT TO APPROVAL BY LOCAL AUTHORITY

CONCRETE GREASE TRAP DETAIL

NO SCALE

02



SAMPLE WELL BASIN

NO SCALE

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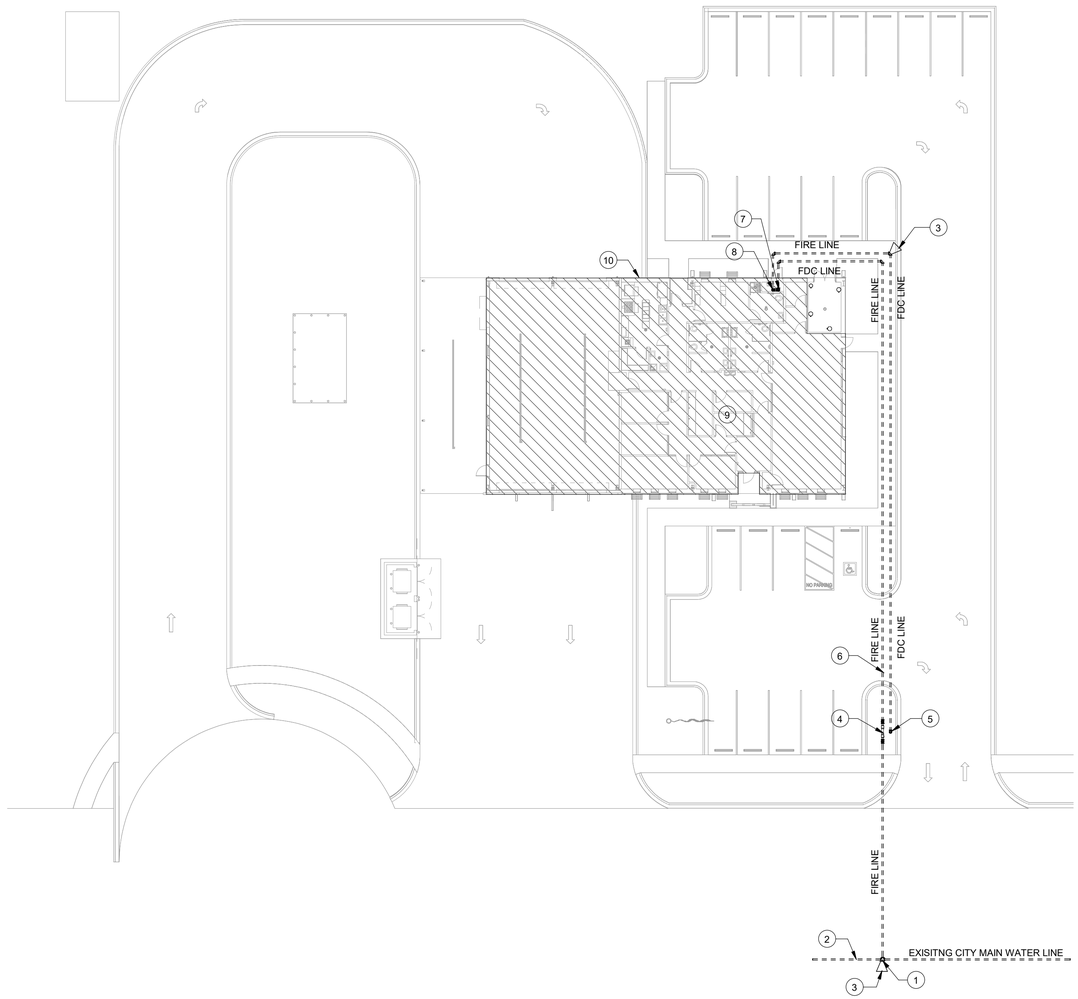
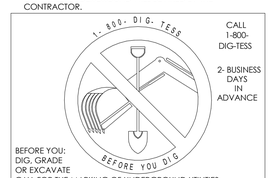


1 FIRE PROTECTION SITE PLAN
1" = 20'-0"

GENERAL NOTES: FIRE PROTECTION

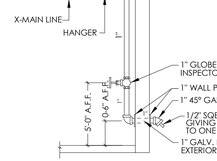
A. SYSTEM TO BE DESIGNED TO MEET CITY OF ELSA AND FIRE MARSHAL CODES. FIRE MARSHAL TO BE THE FINAL APPROVING AUTHORITY FOR ALL FIRE PROTECTION WORK.
B. FIRE DEPARTMENT CONNECTION SHALL BE AS REQUIRED BY LOCAL FIRE MARSHAL.
C. ALL PIPE TO BE SIZED HYDRAULICALLY.
D. ALL PIPING UNDER SLAB SHALL BE STAINLESS STEEL. ELSE USE DUCTILE IRON. VERIFY WITH LOCAL APPROVING AUTHORITY.
E. DETAILS DESCRIBE SOME SPRINKLER COMPONENTS REQUIRED BY A AUTOMATICALLY OPERATED SYSTEM. SPRINKLER CONTRACTOR TO PROVIDE ALL SYSTEM COMPONENTS REQUIRED FOR A TURN KEY FIRE SPRINKLER SYSTEM.
F. PROVIDE SIGNS FOR FDC, ALL VALVES, AND RISER.
G. HAZARD CLASSIFICATION SHALL BE AS PER NFPA 13.
H. ALL UNDERGROUND PIPE TO BE DR-18 C900 AND TO BE INSTALLED AS PER NFPA 24.
I. ALL PIPE LEFT WITH TRAP WATER NEEDS TO BE PROVIDED W/ A DRAIN VALVE.
J. REFER TO SPECIFICATIONS FOR FURTHER INSTRUCTIONS.
K. ANY PROPOSED DCDA FOR THE PROJECT WILL REQUIRE PERMIT FROM HARLINGEN WATER WORKS SYSTEM (HWWS).
L. ALL EXPOSED PIPE TO BE PROTECTED AGAINST FREEZING AS PER NFPA 13.
M. SEAL ALL WALL OPENINGS W/ MORTAR OR FIRE CAULKING.
N. NO FIRE SPRINKLER PIPING TO RUN OVER ELECTRICAL EQUIPMENT, IT ROOM AND ANY OTHER SYSTEM THAT MAY BE DAMAGED FROM WATER LEAK.

NOTE: CARE SHALL BE TAKEN DURING DIGGING. ALL LINES DAMAGED UNDERGROUND WILL BE FIXED BY THE CONTRACTOR.

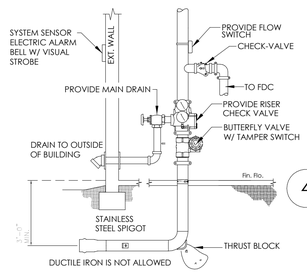


FIRE PROTECTION KEYED NOTES	
1	FIRE SPRINKLER LINE TO CONNECT TO EXISTING CITY WATER LINE. SEE DETAIL 2/FP01.
2	EXISTING CITY WATER LINE. SEE CIVIL PLANS TO VERIFY EXACT SIZE AND LOCATION.
3	3000 PSI CONCRETE THRUST BLOCK AT EVERY CHANGE IN DIRECTION AS PER NFPA24.
4	PROVIDE BACKFLOW PREVENTER. CONTRACTOR COORDINATE EXACT LOCATION. SEE DETAIL 6/FP01.
5	PLACE F.D.C. IN THIS LOCATION. COORDINATE EXACT LOCATION WITH A.H.J. PROVIDE SIGN WITH BUILDING IT SERVES. SEE DETAIL 4/FP01.
6	RUN FIRE MAIN AND FDC LINES BETWEEN 3 AND 4 FEET DEEP. PROVIDE 4 INCHES OF SAND UNDER PIPE. COVER ALL PIPE AND LEAVE JOINTS EXPOSED FOR ENGINEER AND FIRE DEPARTMENT INSPECTION.
7	FIRE SPRINKLER SYSTEM RISER SHALL BE PLACED IN THIS ROOM. SEE DETAIL 5/FP01.
8	DROP F.D.C. LINE DOWN AND PROVIDE STAINLESS STEEL RISER AT FLOOR PENETRATION.
9	THIS IS A NEW BUILDING FACILITY. PROVIDE A NEW FIRE PROTECTION SYSTEM. COORDINATE WITH ALL OTHER TRADES.
10	PROVIDE INSPECTOR TEST. CONTRACTOR COORDINATE EXACT LOCATION. SEE DETAIL 3/FP01.

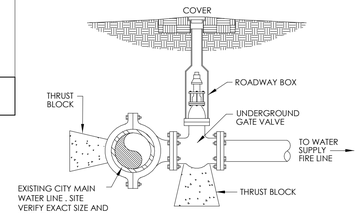
THIS DRAWING IS DIAGRAMMATIC AND SHOULD BE USED AS REFERENCE FOR BIDDING PURPOSES ONLY. THIS DRAWING SHALL NOT BE USE FOR PERMIT OR CONSTRUCTION.
CONTRACTOR IS FULLY RESPONSIBLE FOR THE DESIGN OF THE NEW FIRE SPRINKLER SYSTEM. ALL NFPA CODES APPLICABLE SHALL BE USED AND FOLLOWED.



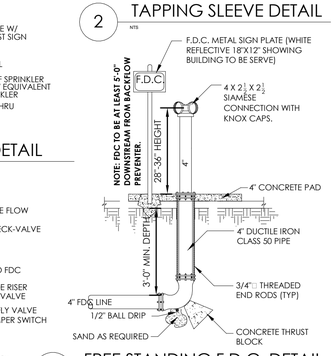
3 INSPECTOR'S TEST DETAIL
NTS



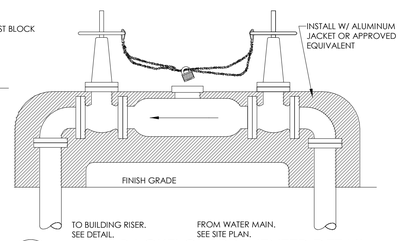
5 RISER ROOM DETAIL
NTS



2 TAPPING SLEEVE DETAIL
NTS



4 FREE STANDING F.D.C. DETAIL
NTS



6 BACKFLOW PREVENTER DETAIL
NTS

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SHEET NUMBER
FP01

SPECIFICATIONS

Hidalgo County Remote Operations Center- Precinct 1

Hidalgo County Remote Operations Centers
Precinct 1
Elsa, TX

More Attentive Service

Milnet Architectural Services, PLLC

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McAllen, Texas 78501

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Project No. 224003

Set No:

PROJECT MANUAL

Plans and Specifications – Project No. 224003

Hidalgo County Remote Operations Centers-
Precinct 1
Elsa, Texas 78543

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Hidalgo County Remote Operations Center-
Precinct 1
Elsa, Texas 78543
MAS Project No. 224003

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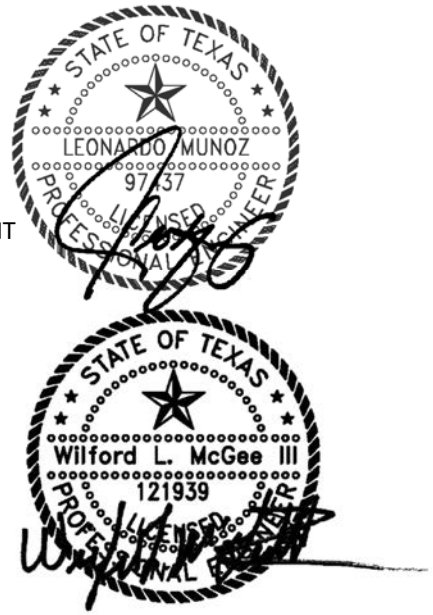

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Hidalgo County Remote Operations Center
Elsa, Texas

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10-8-24

GEOTECHNICAL ENGINEERING STUDY

FOR

PROPOSED HIDALGO COUNTY REMOTE OPERATIONS CENTERS
HIDALGO COUNTY, TEXAS

RABA KISTNER

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Project No. AMA24-035-00
August 20, 2024

Ms. Jireh Lira, CTCD
Contract Specialist III
County of Hidalgo Purchasing Department
2802 S. Business Highway 281
Edinburg, Texas 78539

Re: Geotechnical Engineering Study
Proposed Hidalgo County Remote Operations Centers
1) 8066 N. Los Ebanos Road
Mission, Hidalgo County, Texas
2) 708 E. Edinburg Avenue
Elsa, Hidalgo County, Texas

Dear Ms. Lira:

RABA KISTNER, INC. (RKI) is pleased to submit the report of our Geotechnical Engineering Study for the above-referenced project. This study was performed in general accordance with **RKI** Proposal No. PMA24-033-00, dated June 5, 2024. Written authorization to proceed with this study was received by our office via electronic-mail attachment on Friday, July 12, 2024, by means of the *Agreement for Professional Engineering Services for Geotechnical and Construction Material Testing* between Hidalgo County (CLIENT) and **RKI** dated June 11, 2024. The purpose of this study was to drill borings within the project sites, to perform laboratory testing to classify and characterize subsurface conditions, and to provide foundation and pavement design recommendations and construction guidelines for the proposed remote operations centers.

The following report contains our foundation and pavement recommendations and construction considerations based on our current understanding of the design tolerances, and structural and pavement loads. If any of these parameters change, then there may be alternatives for value engineering of the foundation system, and **RKI** recommends that a meeting be held with County of Hidalgo (CLIENT) and the design team to evaluate these alternatives.

We appreciate the opportunity to be of professional service to you on this project. Should you have any questions about the information presented in this report, please call. We look forward to assisting County of Hidalgo during the construction of the project by conducting the construction materials engineering and testing services (quality assurance program).

Very truly yours,

RABA KISTNER, INC.

Adamari Davila, EIT
Graduate Engineer

Katrin M. Leonard, P.E.
Vice President

STATE OF TEXAS
KATRIN M. LEONARD
95810
LICENSED PROFESSIONAL ENGINEER
Aug. 20, 2024

AD/KML

Attachments

Copies Submitted: Above (1)

GEOTECHNICAL ENGINEERING STUDY

For

PROPOSED HIDALGO COUNTY REMOTE OPERATIONS CENTERS
HIDALGO COUNTY, TEXAS

Prepared for

COUNTY OF HIDALGO
Edinburg, Texas

Prepared by

RABA KISTNER, INC.
McAllen, Texas

PROJECT NO. AMA24-035-00

August 20, 2024

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Important Information About Your Geotechnical Engineering Report

INTRODUCTION

RABA KISTNER, INC. (RKI) has completed the authorized subsurface exploration for the proposed remote operations centers to be located in Mission and in Elsa, Hidalgo County, Texas. This report briefly describes the procedures utilized during this study and presents our findings along with our recommendations for site preparation, and foundation and pavement design and construction considerations, as well as pavement design and construction guidelines.

PROJECT DESCRIPTION

The facilities being considered in this study includes the design and construction of two remote operations centers. The remote operation centers will include a single-story, about 4,700 ft², operations building, and their associated canopies, parking and driveway areas. Currently, the subject sites can be described as undeveloped tracts of land. In general, the topography at these subject sites is relatively level, with an estimated vertical relief of about 3 ft across the sites. Surface drainage at the sites are estimated to be poor-to-fair. The remote operations centers are planned to be located at the following sites:

1) 8066 N. Los Ebanos Road in Mission, Hidalgo County, Texas; and
2) 708 E. Edinburg Avenue in Elsa, Hidalgo County, Texas.

For purposes of this geotechnical engineering report, the finished grade elevation (FGE) of the proposed buildings was assumed to be about 12 inches above the ground surface elevations existing at the time of our study, since no site grading information was provided to us at the time of the preparation of this report. The pavement systems are anticipated to consist of either flexible (asphalt) and/or rigid (concrete) pavements.

LIMITATIONS

This engineering report has been prepared in accordance with accepted Geotechnical Engineering practices in the region of South Texas for the use of County of Hidalgo (CLIENT) and its representatives for design purposes. This report may not contain sufficient information for purposes of other parties or other uses and is not intended for use in determining construction means and methods.

The recommendations submitted in this report are based on the data obtained from 12 borings drilled within the subject sites (6 borings drilled at each site), and the assumption that site grading will result in only minor changes in the topography existing at the time of our study. If the project information described in this report is incorrect, is altered, or if new information is available, we should be retained to review and modify our recommendations.

This report may not reflect the actual variations of the subsurface conditions across the subject sites. The nature and extent of variations across the subject sites may not become evident until construction commences. The construction process itself may also alter subsurface conditions. If variations appear evident at the time of construction, it may be necessary to reevaluate our recommendations after performing on-site observations and tests to establish the engineering impact of the variations.

The scope of our Geotechnical Engineering Study does not include an environmental assessment of the air, soil, rock, or water conditions either on or adjacent to the sites. No environmental opinions are presented in this report. **RKI**'s scope of work does not include the investigation, detection, or design related to the prevention of any biological pollutants. The term "biological pollutants" includes, but is not limited to, mold, fungi, spores, bacteria, and viruses, and the byproduct of any such biological organisms.

If final grade elevations are significantly different from the grades existing at the time of our study (more than plus or minus 1 ft), our office should be informed about these changes. If needed and/or desired, we will reexamine our analyses and make supplemental recommendations.

BORING AND LABORATORY TESTS

Subsurface conditions at the subject sites were evaluated by conducting 12 borings as shown in the following table:

Project Site	Proposed Structure	Number of Borings	Depth, ft. *	Boring Identification
Mission Site	Canopies	1	40	B-1
	Operations Buildings	1	30	B-2
	Pavement Areas	4	10	P-1 through P-4
Elsa Site	Canopies	1	40	B-3
	Operations Buildings	1	30	B-4
	Pavement Areas	4	10	P-5 through P-8

* below the existing ground surface elevation, or auger refusal, whichever occurs first.

The borings (designated as "B-") were drilled on July 23, 2024 and on August 1, 2024, at the locations shown on the Boring Location Maps, Figures 1 and 10. The borings were drilled utilizing straight flight augers and backfilled with the auger cuttings following completion of the drilling operations. During the drilling operations, Split-Spoon (with Standard Penetration Test, SPT) and Shelby-Tube (ST) samples were collected.

The SPT and ST samples were obtained in accordance with accepted standard practices and the penetration test results are presented as "blows per foot" on the boring logs. Representative portions of the samples were sealed in containers to reduce moisture loss, labeled, packaged, and transported to our laboratory for subsequent testing and classification.

In the laboratory, each sample was evaluated and visually classified by a member of our Geotechnical Engineering staff in general accordance with the Unified Soil Classification System (USCS). The geotechnical engineering properties of the strata were evaluated by the following laboratory tests: natural moisture content, Atterberg limits, unconfined compressive strength tests, dry unit weight determinations, sulfate content determinations, and percent passing a No. 200 sieve determinations.

The results of the field and laboratory tests are presented in graphical or numerical form on the boring logs illustrated on Figures 2 through 7, and Figures 11 through 16. A key to the classification of terms and symbols used on the logs is presented on Figures 8 and 17. The results of the laboratory and field testing are also tabulated on Figures 9 and 18 for ease of reference.

Standard penetration test results are noted as "blows per ft" on the boring logs and on Figures 9 and 18, where "blows per ft" refers to the number of blows by a falling hammer required for 1 ft of penetration into the soil.

Samples will be retained in our laboratory for 30 days after submittal of this report. Other arrangements may be provided at the request of the CLIENT.

GENERAL SITE CONDITIONS

GEOLOGY

Mission Site (Borings B-1, B-2, and P-1 through P-4)

A cursory review of the Geologic Atlas of Texas, (McAllen-Brownsville Sheet, dated 1976), published by the Bureau of Economic Geology at the University of Texas at Austin, indicates that the subject site appears to be located Within windblown deposits consisting of stabilized sand dune deposits of the Quaternary (Holocene period).

According to the Soil Survey of Hidalgo County, Texas, published by the United States Department of Agriculture - Soil Conservation Service, in cooperation with the Texas Agricultural Experiment Station, the project sites appear to be located within the Brennan-Hidalgo soil association consisting of deep, moderately permeable soils that typically have a dark brown or dark grayish brown fine sandy loam surface layer. The corresponding soil symbols appear to be 25, Hidalgo fine sandy clay loam, and 28, Hidalgo sandy clay loam.

Elsa Site (Borings B-3, B-4, and P-5 through P-8)

A cursory review of the Geologic Atlas of Texas, (McAllen-Brownsville Sheet, dated 1976), published by the Bureau of Economic Geology at the University of Texas at Austin, indicates that the subject site appears to be located within windblown deposits consisting of stabilized sand dune deposits of the Quaternary (Holocene period).

According to the Soil Survey of Hidalgo County, Texas, published by the United States Department of Agriculture - Soil Conservation Service, in cooperation with the Texas Agricultural Experiment Station, the project sites appear to be located within the Hidalgo soil association consisting of deep, moderately permeable soils that typically have a dark grayish brown sandy clay loam surface layer. The corresponding soil symbol appears to be 28, Hidalgo sandy clay loam.

SEISMIC COEFFICIENTS

Mission Site (Borings B-1, B-2 and P-1 through P-4)

Based upon a review of Section 1613 *Earthquake Loads* of the 2015 International Building Code (IBC), the following information has been summarized for seismic considerations associated with these sites.

- Site Class Definition (Chapter 20 of the American Society of Civil Engineers [ASCE] 7): **Class D**. Based on the soil boring conducted for this investigation, the upper 100 feet of soil may be may be characterized as a stiff soil profile.
- Risk-Targeted Maximum Considered Earthquake Ground Motion Response Accelerations for the Conterminous United Stated of a 0.2-Second, Spectral Response Acceleration (5% of Critical Damping): **S_s = 0.043g**.
- Risk-Targeted Maximum Considered Earthquake Ground Motion Response Accelerations for the Conterminous United States of a 1-Second, Spectral Response Acceleration (5% of Critical Damping): **S_1 = 0.015g**.
- Value of Site Coefficient: **F_a = 1.6**.
- Value of Site Coefficient: **F_v = 2.4**.

The Maximum Considered Earthquake Spectral Response Accelerations are as follows:

- 0.2 sec., adjusted **S_{ms} = 0.069g**.
- 1 sec., adjusted **S_{m1} = 0.035g**.

The Design Spectral Response Acceleration Parameters are as follows:

- 0.2 sec. **S_{DS} = 0.046g**.
- 1 sec. **S_{D1} = 0.023g**.

Elsa Site (Borings B-3, B-4, and P-5 through P-8)

Based upon a review of Section 1613 *Earthquake Loads* of the 2015 International Building Code (IBC), the following information has been summarized for seismic considerations associated with these sites.

- Site Class Definition (Chapter 20 of the American Society of Civil Engineers [ASCE] 7): **Class D**. Based on the soil boring conducted for this investigation, the upper 100 feet of soil may be may be characterized as a stiff soil profile.
- Risk-Targeted Maximum Considered Earthquake Ground Motion Response Accelerations for the Conterminous United Stated of a 0.2-Second, Spectral Response Acceleration (5% of Critical Damping): **S_s = 0.043g**.

- Risk-Targeted Maximum Considered Earthquake Ground Motion Response Accelerations for the Conterminous United States of a 1-Second, Spectral Response Acceleration (5% of Critical Damping): **S_1 = 0.015g**.
- Value of Site Coefficient: **F_a = 1.6**.
- Value of Site Coefficient: **F_v = 2.4**.

The Maximum Considered Earthquake Spectral Response Accelerations are as follows:

- 0.2 sec., adjusted **S_{ms} = 0.069g**.
- 1 sec., adjusted **S_{m1} = 0.035g**.

The Design Spectral Response Acceleration Parameters are as follows:

- 0.2 sec. **S_{DS} = 0.046g**.
- 1 sec. **S_{D1} = 0.024g**.

STRATIGRAPHY

On the basis of borings B-1, B-2, and P-1 through P-4, the subsurface stratigraphy at the Mission site can be described as moderately plastic, cohesive soils and fine-grained soils with various amount of sand. The subsurface stratigraphy at the Elsa site can be described as plastic, fine-grained soils with various amount of sand, based on Borings B-3, B-4, and P-5 through P-8.

Each stratum has been designated by grouping materials that possess similar physical and engineering characteristics. The boring logs should be consulted for more specific stratigraphic information. Unless noted on the boring logs, the lines designating the changes between various strata represent approximate boundaries. The transition between materials may be gradual or may occur between recovered samples. The stratification given on the boring logs, or described herein, is for use by **RKI** in its analyses and should not be used as the basis of design or construction cost estimates without realizing that there can be variation from that shown or described.

The boring logs and related information depict subsurface conditions only at the specific locations and times where sampling was conducted. The passage of time may result in changes in conditions, interpreted to exist, at or between the locations where sampling was conducted.

GROUNDWATER

Groundwater was not observed in the borings conducted within the Mission site either during or immediately upon completion of the field drilling activities.

Groundwater was encountered within the Elsa site during our drilling operations in Borings B-3 and B-4 at a depth of about 16-1/2 ft and 17 ft below the ground surface elevation existing at the time of our study.

The groundwater level in the borings may not have stabilized, particularly in less permeable cohesive soil, prior to backfilling. It is possible for groundwater to exist beneath these sites at shallower depths on a transient basis following periods of precipitation. Fluctuations in groundwater levels occur due to variations in rainfall and surface water run-off. In addition, groundwater may potentially occur as a perched condition at the planned fill and soil interface, or within permeable soils or backfill. The construction process itself may also cause variations in the groundwater level.

FOUNDATION RECOMMENDATIONS AND CONSIDERATIONS

Sites' features that will influence the geotechnical approach to the proposed project include:

- Potential to encounter relatively shallow groundwater seepage during excavation and site grading operations;
- Presence of expansive soil/fill and potential for soil-related movements; and
- Potential for light to moderate foundation loads.

Site grading, if any, can result in changes in almost all aspects of our recommendations. We have prepared the foundation recommendations based on the ground surface elevations and the stratigraphic conditions encountered at the time of our study. If mass site grading is performed at these sites that results in elevations that vary significantly (more than plus or minus 1 ft), we should be informed about these changes. If needed and/or if desired, we will reexamine our analyses and make supplemental recommendations.

The following foundation systems are available to support the proposed structures:

- For the buildings and canopies: Shallow foundation systems consisting of conventional spread and/or continuous footings with fill-supported concrete floor slabs; or
- For the canopies: Alternatively, deep foundation systems, consisting of drilled, straight shaft piers.

Please note that the foundation capacities presented herein are based on the Allowable Stress Design methodology.

GROUNDWATER SEEPAGE AND DEWATERING

As discussed herein, groundwater was encountered within the Elsa site at depths of about 16-1/2 ft and 17 ft below the ground surface elevations existing at the time of our study. However, there is a possibility for groundwater to exist within the sites at shallower depths than those encountered in our borings (see section titled *Groundwater)*. Fluctuations in groundwater levels and groundwater seepage should be anticipated during construction. The contractor should be made aware and ready to handle/intercept potential water for anticipated excavations.

Where excavations extend into the underlying soil layers groundwater seepage should be anticipated. Raising the finished grade and performing the excavations during the drier season (such as summertime) will aid in reducing the potential for groundwater seepage, but will not eliminate the risk. For relatively

shallow excavations, French drains or trench drains, which are discharged by gravity or sumps, may be required to intercept groundwater seepage so that the excavations are not submerged under water. For deep foundation excavations, this could include the use of slurry drilling and/or temporary casing (including overdrive techniques) to reduce groundwater seepage and sloughing of the soils.

The General Contractor should be prepared to control excess water encountered in the excavations due to perched water, seepage from natural or constructed interfaces (such as but not limited to fill and natural soil interface, utility backfills, other), and/or rainfall. Proper construction procedures and equipment will be critical for proper performance of the dewatered excavations. Additionally, protection of personnel entering the excavations and providing a dry, stable subgrade upon which to construct foundations will be crucial.

EXPANSIVE SOIL-RELATED MOVEMENTS

Mission Site (Borings B-1, B-2, and P-1 through P-4)

The anticipated ground movements due to swelling of the underlying soils at this site were estimated for slab-on-grade construction using the empirical procedure, Texas Department of Transportation (TxDOT) Tex-124-E, Method for Determining the Potential Vertical Rise (PVR). PVR values of less than 1 inch were estimated for the stratigraphic conditions encountered in the borings. The PVR value was estimated using and dry moisture conditions within the regional zone of seasonal moisture variation (active zone of 8 ft).

The TxDOT method of estimating expansive soil-related movements is based on empirical correlations utilizing the measured plasticity indices and assuming typical seasonal fluctuations in moisture content. If desired, other methods of estimating expansive soil-related movements are available, such as estimations based on swell tests and/or soil-suction analyses. However, the performance of these tests and the detailed analysis of expansive soil-related movements were beyond the scope of the current study. It should also be noted that actual movements can exceed the calculated PVR values due to isolated changes in moisture content (such as due to leaks, landscape watering....) or if water seeps into the soils to greater depths than the assumed active zone depth due to deep trenching or excavations.

Drainage Considerations Considerations of surface and subsurface drainage may be crucial to construction and adequate foundation performance of the soil-supported structures. Filling an excavation in relatively impervious plastic clays with relatively pervious select fill material creates a “bathtub” beneath the structures, which can result in ponding or trapped water within the fill unless good surface and subsurface drainage is provided.

Water entering the fill surface during construction or entering the fill exposed beyond the structure lines after construction may create problems with fill moisture control during compaction and increased access for moisture to the underlying expansive clays both during and after construction.

Several surface and subsurface drainage design features and construction precautions can be used to limit problems associated with fill moisture. These features and precautions may include, but are not limited to, the following:

- Installing berms or swales on the uphill side of the construction areas to divert surface runoff away from the excavation/fill area during construction;
- Sloping of the top of the subgrade with a minimum downward slope of 1.5 percent out to the base of a dewatering trench located beyond the structures' perimeter;
- Sloping the surface of the fill during construction to promote runoff of rain water to drainage features until the final lift is placed;
- Sloping of a final, well-maintained, impervious clay or pavement surface (downward away from the proposed structures) over the select fill material and any perimeter drain extending beyond the structures lines, with a minimum gradient of 6 in. in 5 ft;
- Constructing final surface drainage patterns to prevent ponding and limit surface water infiltration at and around the structures' perimeter; and
- Locating the water-bearing utilities, roof drainage outlets, and irrigation spray heads outside of the select fill and perimeter drain boundaries.

Details relative to the extent and implementation of these considerations must be evaluated on a project-specific basis by all members of the project design team. Many variables that influence fill drainage considerations may depend on factors that are not fully developed in the early stages of design. For this reason, drainage of the fill should be given consideration at the earliest possible stages of the project.

Elsa Site (Borings B-3, B-4, and P-5 through P-8)

The anticipated ground movements due to swelling of the underlying soils at this site were estimated for slab-on-grade construction using the empirical procedure, Texas Department of Transportation (TxDOT) Tex-124-E, Method for Determining the Potential Vertical Rise (PVR). PVR values of about 1-1/2 inches were estimated for the stratigraphic conditions encountered in the borings. The PVR value was estimated using dry moisture conditions within the regional zone of seasonal moisture variation (active zone of 8 ft).

The TxDOT method of estimating expansive soil-related movements is based on empirical correlations utilizing the measured plasticity indices and assuming typical seasonal fluctuations in moisture content. If desired, other methods of estimating expansive soil-related movements are available, such as estimations based on swell tests and/or soil-suction analyses. However, the performance of these tests and the detailed analysis of expansive soil-related movements were beyond the scope of the current study. It should also be noted that actual movements can exceed the calculated PVR values due to isolated changes in moisture content (such as due to leaks,

landscape watering....) or if water seeps into the soils to greater depths than the assumed active zone depth due to deep trenching or excavations.

PVR REDUCTION RECOMMENDATIONS (ELSA SITE)

Elsa Site (Borings B-3, B-4, and P-5 through P-8)

As previously mentioned, for purposes of this geotechnical engineering report, the FGE of the proposed building was assumed to be about 12 inches (1 ft) above the ground surface elevation existing at the time of our study, since no site grading information was provided to us at the time of the preparation of this report.

To reduce expansive, soil-related movements in at-grade construction beneath the building's footprint area to about 1 inch, we recommend to remove the upper 12 inches (1 ft) of the existing subgrade clay soils, and to replace them with properly-compacted, suitable, select fill materials up to its FGE, which was assumed to be about 12 inches (1 ft) above the ground surface elevation existing at the time of our study (i.e. total of about 24 inches [2 ft] of select fill placement).

Keep in mind that the estimated PVR values are computed based on the recommendations for the selection and placement of suitable, select fill materials which are addressed in the *Foundation Construction Considerations* section of the report.

Drainage Considerations When overexcavation and select fill replacement is selected as a method to reduce the potential for expansive, soil-related movements at any site, considerations of surface and subsurface drainage may be crucial to construction and adequate foundation performance of the soil-supported structures. Filling an excavation in relatively impervious plastic clays with relatively pervious select fill material creates a "bathtub" beneath the structures, which can result in ponding or trapped water within the fill unless good surface and subsurface drainage is provided.

Water entering the fill surface during construction or entering the fill exposed beyond the structure lines after construction may create problems with fill moisture control during compaction and increased access for moisture to the underlying expansive clays both during and after construction.

Several surface and subsurface drainage design features and construction precautions can be used to limit problems associated with fill moisture. These features and precautions may include, but are not limited to, the following:

- Installing berms or swales on the uphill side of the construction areas to divert surface runoff away from the excavation/fill area during construction;

- Sloping of the top of the subgrade with a minimum downward slope of 1.5 percent out to the base of a dewatering trench located beyond the structures' perimeter;
- Sloping the surface of the fill during construction to promote runoff of rain water to drainage features until the final lift is placed;
- Sloping of a final, well-maintained, impervious clay or pavement surface (downward away from the proposed structures) over the select fill material and any perimeter drain extending beyond the structures lines, with a minimum gradient of 6 in. in 5 ft;
- Constructing final surface drainage patterns to prevent ponding and limit surface water infiltration at and around the structures' perimeter; and
- Locating the water-bearing utilities, roof drainage outlets, and irrigation spray heads outside of the select fill and perimeter drain boundaries.

Details relative to the extent and implementation of these considerations must be evaluated on a project-specific basis by all members of the project design team. Many variables that influence fill drainage considerations may depend on factors that are not fully developed in the early stages of design. For this reason, drainage of the fill should be given consideration at the earliest possible stages of the project.

SHALLOW FOUNDATION

The proposed buildings and canopies may be founded on rigid-engineered beams and slab-on-fills foundations and/or on conventional spread and/or continuous footing foundations, provided that the shallow foundation type(s) can be designed to withstand the estimated soil-related movements, as discussed herein, without impairing either the structural or the operational performance of the structures.

Allowable Soil-Bearing Capacity

Shallow foundations bearing on native, undisturbed soils and/or on new, properly-compacted, suitable, select fill materials may be proportioned using the design parameters shown in the following table:

Shallow Foundation Design Parameters for Mission Site (Borings B-1, B-2, and P-1 through P-4)

Minimum depth below FGE:	24 in.
Minimum beam width:	12 in.
Maximum allowable soil-bearing pressure for continuous footings – grade beams:	1,500 psf
Maximum allowable soil-bearing pressure for spread footings – widened beams:	1,800 psf

Shallow Foundation Design Parameters for Elsa Site (Borings B-3, B-4, and P-5 through P-8)

Minimum depth below FGE:	24 in.
Minimum beam width:	12 in.
Maximum allowable soil-bearing pressure for continuous footings – grade beams:	1,900 psf
Maximum allowable soil-bearing pressure for spread footings – widened beams:	2,300 psf

Where psf = pounds per square feet

The maximum allowable soil-bearing pressures presented previously will provide a factor of safety of about 3, provided that the subgrades are prepared in accordance with the recommendations outlined in the *Site Preparation* subsection of the *Foundation Construction Considerations* section of this report, as well the ground improvement procedure presented in the *PVR Reduction Recommendations (Elsa Site)* section of this report is implemented for the Elsa Site. We estimate total settlements to be on the order of about 1 inch. Differential settlements are typically estimated to be about one-half of the total estimated settlement for most subsurface conditions.

Furthermore, the design parameters presented on the previous table are contingent upon the fill materials being selected and placed in accordance with the recommendations presented in the *Select Fill* subsection of the *Foundation Construction Considerations* section of this report. Should select fill selection and placement differ from the recommendations presented herein, **RKI** should be informed of the deviations in order to reevaluate our recommendations and design criteria.

Wire Reinforcement Institute (WRI) Criteria

Beam and slab-on-fill foundations are sometimes designed using criteria developed by the WRI. On the basis of the subsurface stratigraphy encountered, a general effective plasticity index for the proposed building's foundation of 18 percent for the Mission site, and a general effective plasticity index for the proposed building's foundation of 28 percent for the Elsa site should be utilized. A climatic rating (C_w) of 15 should be utilized for the design of the proposed structures' foundations.

Considerations for Shallow Foundation Excavations

Shallow foundation excavations should be observed by the Geotechnical Engineer or their representative prior to placement of reinforcing steel and concrete. This is necessary to document that the bearing soils at the bottom of the excavations are similar to those encountered in the borings and that excessive soft materials and water are not present in the excavations. If soft or yielding soils are encountered in the foundation excavations, they should be removed and replaced with a compacted non-expansive fill material or lean concrete up to the design foundation bearing elevation.

Disturbance from foot traffic and from the accumulation of excess water can result in losses in bearing capacity and increased settlement. If inclement weather is anticipated at the time construction, consideration should be given to protecting the bottoms of beam trenches by placing a thin mud mat

(layer of flowable fill or lean concrete) at the bottom of trenches immediately following excavation. This will reduce disturbance from foot traffic and will impede the infiltration of surface water. All necessary precautions should be implemented to protect open excavations from the accumulation of surface water runoff and rain.

AREA FLATWORK

It should be noted that ground-supported flatwork such as walkways, driveways, courtyards, sidewalks, etc., will be subject to the same magnitude of potential soil-related movements as discussed previously (see *Expansive, Soil-Related Movements* subsection of this report) for the sites. Thus, where these types of elements abut rigid building foundations or isolated structures, differential movements should be anticipated. As a minimum, we recommend that flexible joints be provided where such elements abut the main buildings to allow for differential movement at these locations. Where the potential for differential movement is objectionable, it may be beneficial to consider methods of reducing anticipated movements to match the adjacent structures' performance.

DRILLED, STRAIGHT-SHAFT PIERS

Alternatively, drilled, straight-shaft piers may also be considered to support the proposed canopies. For both sites, we recommend that piers extend to a minimum depth of 12 ft below the ground surface elevations existing at the time of our study or below final grade, whichever is greater. The piers may be designed as both end bearing units and as friction units utilizing the maximum allowable end-bearing pressures and the allowable side shear resistance values tabulated in the following tables.

Mission Site (Borings B-1, B-2, and P-1 through P-4)

Approximate Depth Range (ft) *	Maximum Allowable End-Bearing Pressure (ksf)
12 to 30	11.0

*below the ground surface elevations existing at the time of our study.

Approximate Depth Range (ft) *	Allowable Side Shear Resistance (ksf)
0 to 8	Neglect
8 to 30	1.0

*below the ground surface elevations existing at the time of our study.

Elsa Site (Borings B-3, B-4, and P-5 through P-8)

Approximate Depth Range (ft) *	Maximum Allowable End-Bearing Pressure (ksf)
12 to 30	7.5

*below the ground surface elevations existing at the time of our study.

Approximate Depth Range (ft) *	Allowable Side Shear Resistance (ksf)
0 to 8	Neglect
8 to 30	0.65

*below the ground surface elevations existing at the time of our study.

To proportion the drilled piers for axial compression, the side shear resistance should be neglected along the portion of the shaft located one shaft diameter from the bottom of the pier. The allowable values for end bearing and side shear resistance were evaluated using factors of safety of 3 and 2, respectively. Based on the 40-ft maximum depth of exploration, pier depths should not exceed a depth of 30 ft below the ground surface elevations existing at the time of our study.

It is recommended that the pier shafts be a minimum of 24 inches in diameter to facilitate reinforcing steel placement and shaft observation prior to placing concrete. Casing and/or slurry drilling techniques will be required for drilled, straight-shaft pier construction.

Pier Shaft Potential Uplift Forces

The pier shafts will be subjected to potential uplift forces if the surrounding expansive soils within the active zone are subjected to alternate drying and wetting conditions. The maximum potential uplift force acting on the shafts may be estimated by:

Negligible **Mission Site (Borings B-1, B-2, and P-1 through P-4)**

$F_u = 15\ D$ **Elsa Site (Borings B-3, B-4, and P-5 through P-8)**

Where: F_u = uplift force in kips; and
D = diameter of the shaft in feet.

Allowable Uplift Resistance

Resistance to uplift forces exerted on the drilled, straight-shaft piers will be provided by the sustained compressive axial force (dead load) plus the allowable uplift resistance provided by the soil. The resistance provided by the soil depends on the shear strength of the soils adjacent to the pier shaft and below the depth of the active zone. The allowable uplift resistance values provided by the soils at these sites are tabulated on the following table. These values were evaluated using a factor of safety of 2.

Mission Site (Borings B-1, B-2, and P-1 through P-4)

Approximate Depth Range* (ft)	Allowable Uplift Resistance (ksf)
0 to 8	0
8 to 30	0.65

*below the ground surface elevations existing at the time of our study.

Elsa Site (Borings B-3, B-4, and P-5 through P-8)

Approximate Depth Range* (ft)	Allowable Uplift Resistance (ksf)
0 to 8	0
8 to 30	0.45

*below the ground surface elevations existing at the time of our study.

Reinforcing steel will be required in each pier shaft to withstand a net force equal to the uplift force minus the uplift resistive force and the sustained compressive load carried by the pier. We recommend that each pier be reinforced to withstand this net force or an amount equal to 1 percent of the cross-sectional area of the shaft, whichever is greater.

PIER SPACING

Where possible, we recommend that the drilled, straight-shaft piers be spaced at a distance of at least three shaft diameters on-center. Such spacing will not require a reduction in the load carrying capacity of the individual piers.

If design and/or construction restraints require that piers be spaced closer than the above recommended spacing, **RKI** must be retained to re-evaluate the allowable bearing capacity presented above for the individual piers. Reductions in load-carrying capacities may be required depending upon individual loading and spacing conditions.

LATERAL RESISTANCE

Resistance to lateral loads and the expected pier behavior under the applied loading conditions will depend not only on subsurface conditions, but also on loading conditions, the pier size, and the engineering properties of the pier. The pier should be analyzed to determine the resulting lateral deflections, maximum bending moments, and ultimate bending moments. This type of analysis is typically performed utilizing a computer analysis program and usually requires a trial and error procedure to appropriately size the pier and meet project tolerances.

To assist the structural engineer in this procedure, we are providing the following subsurface parameters for use in analysis. These parameters are in accordance with the input requirements of one of the more commonly used computer programs for laterally-loaded piles, the “L-Pile Plus” program. If a different

program is used for analysis, different parameters may be required and different limitations may be required than what was assumed in selecting the parameters given in the following table. Thus, if a program other than "L-Pile Plus" is used, **RKI** must be notified of the analysis method and the required soil parameters, so that we can review and revise our recommendations, if required. The soil-related parameters required for input into the "L-Pile Plus" program are summarized in the following table:

Mission Site (Borings B-1, B-2, and P-1 through P-4)

Soil Type	Approximate Depth Range (ft)*	c, tsf	ϕ (°)	ε_{50}	k_s, (pci)	k_c, (pci)	γ, (pcf)
Sand and Clay Soils (Above the Groundwater Table)	0 to 5	Neglect					
Sand Soils (Above the Groundwater Table)	5 to 15	--	29	--	90	90	100
Clay Soils (Above the Groundwater Table)	15 to 30	1.8	--	0.004	2,000	800	110

* below the ground surface elevation existing at the time of our study.

Elsa Site (Borings B-3, B-4, and P-5 through P-8)

Soil Type	Approximate Depth Range (ft)*	c, tsf	ϕ (°)	ε_{50}	k_s, (pci)	k_c, (pci)	γ, (pcf)
Clay Soils (Above the Groundwater Table)	0 to 5	Neglect					
Clay Soils (Above the Groundwater Table)	5 to 25	1.3	--	0.007	500	200	100
Sand Soils (Below the Groundwater Table)	25 to 30	--	30	--	90	90	57

* below the ground surface elevation existing at the time of our study.

Where:

c = undrained shear strength
ϕ = angle of internal friction
ε_{50}= strain at 50 percent
k_s = horizontal modulus of subgrade reaction (static)
k_c = horizontal modulus of subgrade reaction (cyclic)
γ = density (effective unit weight)

The values presented in the previous tables for subgrade modulus and the strain at 50% are based on recommended values for the "L-Pile Plus" computer program for the strength of the subsurface conditions encountered in the borings, and are not necessarily based on laboratory test results.

The parameters presented in the previous tables **do not** include factors of safety. Consequently, it is recommended that a factor of safety of at least 2 be introduced to the analysis by doubling the applied lateral loads and moments.

CONSIDERATIONS FOR DRILLED PIERS

If implemented, drilled pier excavations must be examined by an **RKI** representative who is familiar with the geotechnical aspects of the subsurface stratigraphy, the structural configuration, foundation design details, and assumptions prior to placing concrete. This is to observe that:

- The shaft has been excavated to the specified dimensions at the correct depth established by the previously mentioned criteria;
- The shaft has been drilled plumb within specified tolerances along its total length; and
- Excessive cuttings, buildup and soft, compressible materials have been removed from the bottom of the excavation.

Drilled pier excavation observations should be scheduled with the Geotechnical Engineer a minimum of 48 hours prior to pier drilling. Failure to do so will be the responsibility of the General Contractor.

REINFORCEMENT AND CONCRETE PLACEMENT

Reinforcing steel should be checked for size and placement prior to concrete placement. Placement of concrete should be accomplished as soon as possible after excavation to reduce changes in the moisture content or the state of stress of the foundation materials. Concrete should not be placed in the pier excavations without the approval of the Engineer. No foundation element should be left open overnight without concreting.

TEMPORARY CASING

Groundwater was observed within the Elsa site at depths of about 16-1/2 ft and 17 ft below the ground surface elevations existing at the time of our study. Groundwater seepage and/or side sloughing will be encountered at the time of construction, depending on climatic conditions prevalent at the time of construction. Therefore, we recommend that the bid documents require the foundation contractor to specify unit costs for different lengths of casing and/or slurry drilling techniques which will be required.

GRADE BEAMS

For the structures being considered, we recommend that the grade beams interconnecting the piers be ground-supported on properly-compacted, suitable select fill materials, but designed to span the piers.

FLOOR SLABS

For the structures being considered, the floor slabs may be ground supported on properly-compacted, suitable, select fill materials, provided that the anticipated movements discussed under the *Expansive Soil-Related Movements* section of this report will not impair the performance of the floor, frame, or roof systems.

FOUNDATION CONSTRUCTION CONSIDERATIONS

SITE DRAINAGE

Drainage is an important key to the successful performance of any foundation. Good surface drainage should be established prior to and maintained after construction to help prevent water from ponding within or adjacent to the structures' foundations and to facilitate rapid drainage away from the structures' foundations. Failure to provide positive drainage away from the structures can result in localized differential vertical movements in soil the supported foundations and floor slabs.

Current ordinances, in compliance with the Americans with Disabilities Act (ADA), may dictate maximum slopes for walks and drives around and into new buildings. These slope requirements can result in drainage problems for the ground-supported buildings. We recommend that, on all sides of the proposed structures' foundations, the maximum permissible slope be provided away from the proposed buildings.

Also to help control drainage in the vicinity of the structures, we recommend that roof/gutter downspouts and landscaping irrigation systems not be located adjacent to the structures' foundations. Where a select fill overbuild is provided outside of the floor slab/foundation footprints, the surface should be sealed with an impermeable layer (pavement or clay cap) to reduce infiltration of both irrigation and surface waters. Careful consideration should also be given to the location of water bearing utilities, as well as to provisions for drainage in the event of leaks in water bearing utilities. All leaks should be immediately repaired.

Other drainage and subsurface drainage issues are discussed in the Expansive Soil-Related Movements section of this report

SITE PREPARATION

The structures' areas and all areas to support new fills should be stripped of all vegetation and/or organic topsoil down to a minimum depth of 8 inches and extending a minimum of 5 ft beyond the structures' footprint areas. Further, for the Elsa site, we recommend that the site improvement procedure presented in the *PVR Reduction Recommendations (Elsa Site)* section of this report be implemented within the proposed structures' footprint areas in order to strengthen and densify the surficial subgrade soils.

Exposed subgrades should be thoroughly proofrolled in order to locate and densify any weak, compressible zones. A minimum of 5 passes of a fully-loaded dump truck or a similar heavily-loaded piece of construction equipment should be used for planning purposes. Proofrolling operations should be observed by the Geotechnical Engineer or their representative to document subgrade conditions and preparation. Weak or

soft areas identified during proofrolling should be treated with hydrated lime or Portland cement, or removed and replaced with a suitable, compacted select fill in accordance with the recommendations presented under the *Select Fill* subsection of this section of the report. If the treatment option is selected, the weak or soft areas may be mixed with hydrated lime or Portland cement down to a minimum depth of 8 inches in order to aid in drying the soils and develop a firm working surface. Proofrolling operations and any excavation/backfill activities should be observed by **RKI** representatives to document subgrade preparation.

Upon completion of the proofrolling operations and just prior to fill placement, the exposed subgrades should be moisture-conditioned by scarifying to a minimum depth of 8 in. and recompacting to a minimum of 98 percent of the maximum dry density as determined from the ASTM D698, Compaction Test. The moisture content of the subgrades should be maintained within the optimum moisture content to three percentage points above the optimum moisture content until permanently covered.

SELECT FILL

Materials used as select fill for final site grading preferably should be crushed stone or gravel aggregate. We recommend that materials specified for use as select fill meet the TxDOT 2014 Standard Specification for Construction and Maintenance of Highways, Streets, and Bridges, Item 247, Flexible Base, Type A through Type E, Grades 1, 2, 3, and 5.

Alternatively, the following soils, as classified according to the USCS, may be considered satisfactory for use as select fill materials at these sites: SC, GC, CL, and combinations of these soils. In addition to the USCS classification, alternative select fill materials shall have a maximum liquid limit of 40 percent, a plasticity index between 7 and 18 percent, and a maximum particle size not exceeding 4 inches or one-half the loose lift thickness, whichever is smaller. In addition, if these materials are utilized, grain size analyses and Atterberg Limits must be performed during placement at a minimum rate of one test each per 5,000 cubic yards of material due to the high degree of variability associated with pit-run materials.

If the above listed alternative materials are being considered for bidding purposes, the materials should be submitted to the Geotechnical Engineer for pre-approval a minimum of 10 working days or more prior to the bid date. Failure to do so will be the responsibility of the General Contractor. The General Contractor will also be responsible for ensuring that the properties of all delivered alternate select fill materials are similar to those of the pre-approved submittal. It should also be noted that when using alternative fill materials, difficulties may be experienced with respect to moisture control during and subsequent to fill placement, as well as with erosion, particularly when exposed to inclement weather. This may result in sloughing of beam trenches and/or pumping of the fill materials.

Soils classified as CH, MH, ML, SM, GM, OH, OL, and Pt under the USCS and not meeting the alternative select fill material requirements, are **not** considered suitable for use as select fill materials at these sites.

Select fill should be placed in loose lifts **not** exceeding 8 in. in thickness and compacted to at least 98 percent of the maximum dry density as determined by ASTM D698. The moisture content of the fill should be

maintained within the range of two percentage points below the optimum moisture content to two percentage points above the optimum moisture content until the final lift of fill is permanently covered.

The select fill should be properly compacted in accordance with these recommendations and tested by **RKI** personnel for compaction as specified.

EXCAVATION SLOPING AND BENCHING

Excavations that extend to or below a depth of 5 ft below construction grade shall require the General Contractor to develop a trench safety plan to protect personnel entering the trench or trench vicinity. The collection of specific geotechnical data and the development of such a plan, which could include designs for sloping and benching or various types of temporary shoring, are beyond the scope of the current study. Any such designs and safety plans shall be developed in accordance with current Occupational Safety and Health Administration (OSHA) guidelines and other applicable industry standards.

EXCAVATION EQUIPMENT

The boring logs are not intended for use in determining construction means and methods and may therefore be misleading if used for that purpose. We recommend that General Contractors and their subcontractors interested in bidding on the work perform their own tests in the form of test pits to determine the quantities of the different materials to be excavated, as well as the preferred excavation methods and equipment for these sites.

PAVEMENT RECOMMENDATIONS

Both flexible and rigid pavement recommendations for a 20-year design period are presented in this report. The CLIENT and/or design team may select either pavement type depending on the performance criteria established for the project. In general, flexible pavement systems have a lower initial construction cost as compared to rigid pavements. However, maintenance requirements over the life of the pavement are typically much greater for flexible pavements. This typically requires regularly-scheduled observation and repair, as well as overlays and/or other pavement rehabilitation at approximately one-half to two-thirds of the design life. Rigid pavements are generally more "forgiving", and therefore tend to be more durable and require less maintenance after construction.

For either pavement type, drainage conditions will have a significant impact on long-term performance, particularly where permeable flexible base materials are utilized in the pavement section. Drainage considerations are discussed in more detail in a subsequent section of this report.

SUBGRADE CONDITIONS

A single generalized subgrade condition has been assumed for each site.

For the Mission site, the predominant subgrade soils used in developing the pavement sections for this project are the moderately plastic, clayey sand soils. On the basis of our experience with similar subsurface

conditions in this area, a design California Bearing Ratio (CBR) value of 6 was assigned to evaluate the pavement components.

For the Elsa site, the predominant subgrade soils used in developing the pavement sections for this project are the plastic, clay soils. On the basis of our experience with similar subsurface conditions in this area, a design California Bearing Ratio (CBR) value of 3 was assigned to evaluate the pavement components.

These design CBR values assumes that the subgrade soils will be prepared in accordance with the recommendations stated in the *Subgrade Preparation* subsection of the *Pavement Construction Guidelines* section of this report.

SULFATE CORROSION POTENTIAL

The potential concentration of soluble sulfates within the subject sites was preliminarily evaluated by conducting laboratory sulfate content tests. The results of these laboratory tests are as follows:

Project Site	Boring Identification	Approximate Depth, ft *	Sulfate Content (ppm)
Mission	P-1	1	140
	P-4	1	100
Elsa	P-6	1	140
	P-8	1	120

* below the ground surface elevation existing at the time of our study.

Where ppm = parts per million

On the basis of these sulfate content test results, the tested on-site subgrade soils do not appear to have a potential to cause sulfate-induced heave. Typically, the concentration of soluble sulfate on soils becomes a concern when the concentration reaches about 3,000 ppm and higher. The sulfate concentration in soils may vary over short distances, and as such, additional testing is recommended at the time of construction to confirm the concentration of sulfates in the exposed subgrade soils within the subject pavement areas.

SWELL/HEAVE POTENTIAL

It should be understood that pavement sections in moderate to highly expansive soil environments can develop longitudinal cracking along unprotected pavement edges. In the semi-arid climate of central Texas, this condition typically occurs along the unprotected edges of pavements where the adjoining grounds are not developed.

The longitudinal cracking generally occurs between 2 to 4 feet inside of and parallel to the unprotected edges of the pavement. The occurrence of these cracks can be more prevalent in the absence of lateral restraint and embankments. Differential drying and shrinkage of the highly expansive soil subgrade between the exposed pavement edge and that beneath the pavement section commonly causes the cracking. This

problem can best be addressed by providing either a horizontal or vertical moisture barrier at the unprotected pavement edge.

A horizontal barrier is commonly in the form of a paved shoulder extending 8 feet or greater beyond the edge of the pavement. Other methods of shoulder treatment, such as using geofabrics beyond the edge of the roadway, are sometimes used in an effort to help reduce longitudinal cracking. Although this alternative does not eliminate the longitudinal cracking phenomenon, the location of the cracking is transferred to the shoulder rather than within the traffic lane.

Vertical barriers installed along the unprotected edges of pavements are also effective in preventing non-uniform drying and shrinkage of the subgrade clays. These barriers are typically in the form of a vertical moisture barrier/membrane extending a minimum of 6 feet below the top of the subgrade at the pavement edge. Both types of barriers must be sealed at the edge of the pavement to prevent a crack that would facilitate the drying of the subgrade soils.

A more economical alternative, which will not limit the shrinkage of the underlying subgrade clays but may help reduce the occurrence of longitudinal cracking, is the use of a geogrid base reinforcement in the pavement section. Geogrid gives the pavement section a tensile strength component that is not otherwise inherent in a typical flexible base pavement section. Another consideration is to treat the subgrade soil with lime.

LIME TREATMENT OF SUBGRADE (ELSA SITE)

In general, the subgrade soils at this site are plastic in nature and can be difficult to work with, particularly during periods of inclement weather. The performance of the subgrade soils may be improved by treating the upper 8 inches with hydrated lime. A sufficient quantity of hydrated lime should be mixed with the subgrade soils to decrease the plasticity index of the soil-lime mixture to 18 percent or less and to increase the pH of the soil-lime mixture to at least 12.4. For estimating purposes, we recommend that a minimum of 3 percent lime by weight be considered for lime treatment. For construction purposes, we recommend that the percent of hydrated lime treatment be determined by appropriate laboratory testing at the time of construction.

Based on a recently reported adverse reaction to lime addition in certain sulfate-containing soils, it is strongly recommended to perform additional laboratory testing to determine the concentration of soluble sulfates in the subgrade soils. The adverse reaction, referred to as sulfate-induced heave, has been known to cause cohesive subgrade soils to swell in short periods of time, resulting in pavement heaving and possible failure

DESIGN INFORMATION

The following recommendations for the pavement sections are based on our experience with similar subgrade soils; assumed traffic loadings; assumed CBR values for the subgrade soils; and design procedures published by the American Association of State Highway and Transportation Officials (AASHTO). The

pavement design and analyses are based directly on the 1993 and 1997 editions of the "Guide for the Design of Pavement Structure" by AASHTO.

For a 20-year design period, Equivalent Single Axle Loads (ESAL's) were estimated for an assumed traffic loading of 1 tractor-trailer truck per day and two garbage trucks per week for the proposed parking lot and driveway areas. This corresponds to about 27,000 ESAL's. **It is recommended that the project Civil Engineer review the above-mentioned levels of traffic and design period to ensure that they are appropriate for the intended use of the proposed remote operations centers.**

FLEXIBLE PAVEMENTS

The following flexible pavement sections are available for the sites:

Project Site	PS (in)	LTS (in)	FBM (in.)	HMAC (in.)
Mission	8	-	10	2
Elsa	-	8	8	2

Where: PS = Prepared Subgrade
LTS = Lime Treated Subgrade
FBM = Flexible Base Material
HMAC = Hot-Mix Asphaltic Concrete Surface Course

Garbage Dumpsters

Where flexible pavements are constructed at any site, it is recommended that reinforced concrete pads be provided in front of and beneath trash receptacles. The dumpster trucks should be parked on the concrete pads when the receptacles are lifted. It is suggested that such pads also be provided in drives where the dumpster trucks make turns with small radii to access the receptacles. The concrete pads at the sites should be a minimum of 5-1/2 inches thick and reinforced with conventional steel reinforcing bars, and underlain by 8 inches of prepared subgrade (for the Mission site) and 8 inches of lime treated subgrade (for the Elsa site).

RIGID PAVEMENTS

The following rigid pavement sections are available for the sites:

Project Site	Prepared Subgrade (in.)	Lime Treated Subgrade (in.)	Reinforced Concrete (in.)
Mission	8	-	5-1/2
Elsa	-	8	5-1/2

Reinforcement steel should consist of reinforcing bars running in both directions. The amount of reinforcing steel can be determined from the following equation:

$A_s = WFL/2f_s$

Where:

A_s = required steel area per ft of width
W = weight of the slab (psf)
F = coefficient of resistance between slab and subgrade (AASHTO recommends 1.8)
f_s = allowable tensile stress in the steel (psi)
L = Length of slab (ft)

Detail for longitudinal and transverse reinforcing steel requirements in jointed reinforced concrete pavements are presented in the AASHTO Design Guide. Detail for longitudinal reinforcing steel requirements in continuously reinforced concrete pavements are presented in the AASHTO 1993 Design Guide. Transverse reinforcing steel requirements in continuously reinforced concrete pavements are the same as for jointed reinforced concrete pavements.

Horizontal dowels or saw cutting to expose existing steel are required to create a minimum 10-inch overlap of reinforcing steel when making a connection of a proposed street to an existing concrete street or drive. When an existing street has no exposed steel, 1¼-inch diameter dowels of 24-inches in length should be embedded 12-inches into the existing pavement, epoxied, and spaced at 12-inches, center-to-center.

PAVEMENT MAINTENANCE

Regular and frequent pavement maintenance is critical in maintaining pavement performance over a period of several years and right after construction is completed. All cracks that develop in asphalt pavements should be regularly sealed. Areas of moderate to severe fatigue cracking (also known as alligator cracking) should be sawcut and removed. The underlying base should be checked for contamination or loss of support and any insufficiencies fixed or removed and the entire area patched.

All cracks that develop in concrete pavements should be routed and sealed regularly. Joints in concrete pavements should be maintained to reduce the influx of incompressible materials that restrain joint movement and cause spalling and/or cracking. Other jurisdictional maintenance techniques should be followed as required.

CONSTRUCTION TRAFFIC

Construction traffic on prepared subgrade or granular base should be restricted as much as possible until the protective rigid or flexible surface pavement is applied. Significant damage to the underlying layers resulting in weakening may occur if heavily loaded vehicles are allowed to use these areas prior to the complete construction of the pavement section.

PAVEMENT CONSTRUCTION CONSIDERATIONS

SUBGRADE PREPARATION

Areas to support pavements should be stripped of all vegetation and/or organic topsoil down to a minimum depth of 8 inches and extend a minimum of 2 ft beyond the pavement perimeters. Upon completion of site stripping activities, the exposed subgrade should be thoroughly proofrolled in accordance with the *Site Preparation* subsection recommendations provided in the *Foundation Construction Considerations* section of this report. Likewise, upon completion of the proofrolling activities and just prior to select fill or flexible base placement, the exposed subgrade should be scarified and recompacted as recommended in such subsection.

DRAINAGE CONSIDERATIONS

As with any soil-supported structure, the satisfactory performance of a pavement system is contingent on the provision of adequate surface and subsurface drainage. Insufficient drainage which allows saturation of the pavement subgrade and/or the supporting granular pavement materials will greatly reduce the performance and service life of the pavement systems.

Surface and subsurface drainage considerations crucial to the performance of pavements at the sites include (but are not limited to) the following:

1) Any known natural or man-made subsurface seepage at the sites which may occur at sufficiently shallow depths as to influence moisture contents within the subgrade should be intercepted by drainage ditches or below grade French drains.
2) Final site grading should eliminate isolated depressions adjacent to curbs which may allow surface water to pond and infiltrate into the underlying soils. Curbs should completely penetrate flexible base materials and should be installed to sufficient depth to reduce infiltration of water beneath the curbs.
3) Pavement surfaces should be maintained to help minimize surface ponding and to provide rapid sealing of any developing cracks. These measures will help reduce infiltration of surface water downward through the pavement section.

ON-SITE SOIL FILL

The pavement recommendations presented in this report were prepared assuming that on-site clay soils will be used for site grading in the proposed pavement areas. If used, we recommend that on-site soils be placed in loose lifts not exceeding 8 in. in thickness and compacted to a minimum of 98 percent of the maximum dry density as determined from ASTM D698. The moisture content of the subgrade should be maintained within the range of two percentage points below the optimum moisture content to two percentage points above the optimum moisture content until permanently covered. We recommend that on-site fill materials be free of roots, vegetation, and/or other organic or degradable material. We also recommend that the maximum particle size not exceed 4 in. or one half the lift thickness, whichever is smaller.

SELECT FILL

If implemented, select fill materials utilized for achieving finished subgrade elevations in pavement areas should be in accordance with the *Select Fill* subsection recommendations provided in the *Foundation Construction Considerations* section of this report.

LIME TREATMENT OF SUBGRADE (ELSA SITE)

Lime treatment of the subgrade soils should be in accordance with the TxDOT 2014 Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges, Item 260, Lime Treatment (Road Mixed). Lime-treated subgrade soils should be compacted to a minimum of 95 percent of the maximum dry density at a moisture content within the range of two percentage points below the optimum moisture content to two percentage points above the optimum moisture content as determined by ASTM D1557.

FLEXIBLE BASE COURSE

The flexible base course should consist of material conforming to TxDOT 2014 Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Item 247, Flexible Base, Type A through Type E, Grades 1, 2, 3, and 5.

The flexible base course should be placed in lifts with a maximum compacted thickness of 8 in. and compacted to a minimum of 95 percent of the maximum dry density as determined by ASTM D1557. The moisture content of the base course materials should be maintained within the range of three percentage points below the optimum moisture content to three percentage points above the optimum moisture content until permanently covered.

ASPHALTIC CONCRETE SURFACE COURSE

The asphaltic concrete surface course should conform to TxDOT 2014 Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Item 341, Dense-Graded Hot-Mix Asphalt, Type C or D. The asphaltic concrete should be compacted to a minimum of 92 percent of the maximum theoretical specific gravity (Rice) of the mixture determined according to Test Method Tex-227-F. Pavement specimens, which shall be either cores or sections of asphaltic pavement, will be tested according to Test Method Tex-207-F.

The nuclear-density gauge or other methods which correlate satisfactorily with results obtained from project roadway specimens may be used when approved by the Engineer. Unless otherwise shown on the plans, the Contractor shall be responsible for obtaining the required roadway specimens at their expense and in a manner and at locations selected by the Engineer.

PORTLAND CEMENT CONCRETE

The Portland cement concrete pavement should be air entrained to result in a 4 percent plus/minus 1 percent air, should have a maximum slump of 5 inches, and should have a minimum 28-day compressive

strength of 3,500 psi. A liquid membrane-forming curing compound should be applied as soon as practical after broom finishing the concrete surface. The curing compound will help reduce the loss of water from the concrete. The reduction in the rapid loss in water will help reduce shrinkage cracking of the concrete.

CONSTRUCTION RELATED SERVICES

CONSTRUCTION MATERIALS TESTING AND OBSERVATION SERVICES

As presented in the attachment to this report, *Important Information About Your Geotechnical Engineering Report*, subsurface conditions can vary across a project site. The conditions described in this report are based on interpolations derived from a limited number of data points. Variations will be encountered during construction, and only the geotechnical design engineer will be able to determine if these conditions are different than those assumed for design.

Construction problems resulting from variations or anomalies in subsurface conditions are among the most prevalent on construction projects and often lead to delays, changes, cost overruns, and disputes. These variations and anomalies can best be addressed if the geotechnical engineer of record, **RKI** is retained to perform construction observation and testing services during the construction of the project. This is because:

- **RKI** has an intimate understanding of the geotechnical engineering report's findings and recommendations. **RKI** understands how the report should be interpreted and can provide such interpretations on site, on the client's behalf.
- **RKI** knows what subsurface conditions are anticipated at these sites.
- **RKI** is familiar with the goals of the owner and project design professionals, having worked with them in the development of the geotechnical workscope. This enables **RKI** to suggest remedial measures (when needed) which help meet the owner's and the design teams' requirements.
- **RKI** has a vested interest in client satisfaction, and thus assigns qualified personnel whose principal concern is client satisfaction. This concern is exhibited by the manner in which contractors' work is tested, evaluated and reported, and in selection of alternative approaches when such may become necessary.
- **RKI** cannot be held accountable for problems which result due to misinterpretation of our findings or recommendations when we are not on hand to provide the interpretation which is required.

BUDGETING FOR CONSTRUCTION TESTING

Appropriate budgets need to be developed for the required construction testing and observation activities. At the appropriate time before construction, we advise that **RKI** and the project designers meet and jointly develop the testing budgets, as well as review the testing specifications as it pertains to this project.

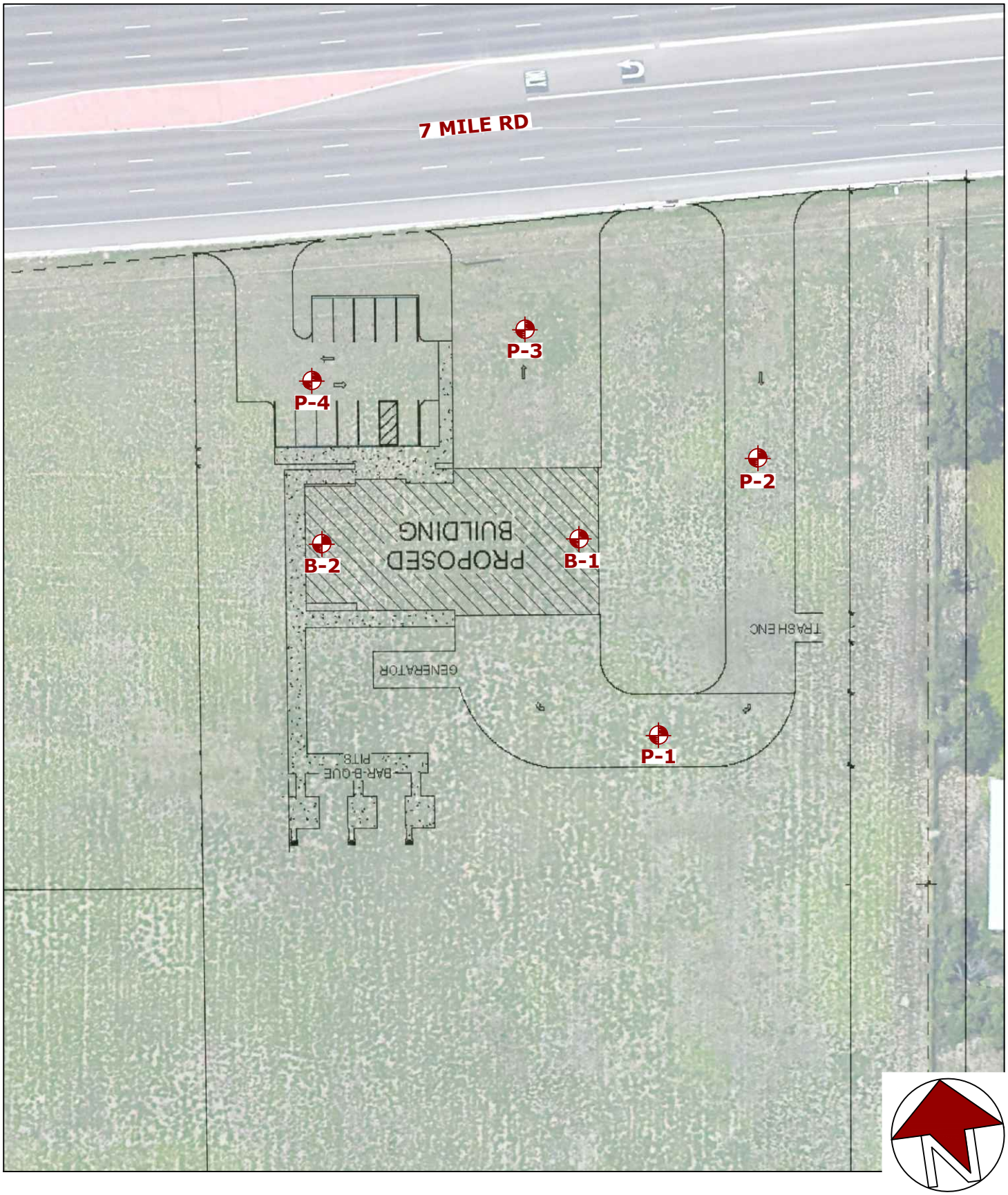
Once the construction testing budget and scope of work are finalized, we encourage a preconstruction meeting with the selected contractor to review the scope of work to make sure it is consistent with the

construction means and methods proposed by the contractor. **RKI** looks forward to the opportunity to provide continued support on this project, and would welcome the opportunity to meet with the Project Team to develop both a scope and budget for these services.

* * * * * * * * * * * * * * * * * * *

ATTACHMENTS

O:\Active Projects\McAllen\2024\AMA24\AMA24-035-00 Prop. Hidalgo County Remote Operations Centers-Mission, Elsa\Drawings\Figure 1.dwg



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BORING LOCATION MAP
PROP. HIDALGO COUNTY
REMOTE OPERATIONS CENTERS

8066 N. LOS EBANOS ROAD
MISSION, HIDALGO COUNTY, TEXAS

REVISIONS:

No.	DATE	DESCRIPTION

PROJECT No.:	AMA24-035-00
ISSUE DATE:	08-20-2024
DRAWN BY:	DV
CHECKED BY:	AD
REVIEWED BY:	KML
FIGURE:	1

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LOG OF BORING NO. B-1

Prop. Hidalgo County Remote Operations Centers
8066 N. Los Ebanos Road
Mission, Hidalgo County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger

LOCATION: See Figure 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT^2 (0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0) / PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT (10 20 30 40 50 60 70 80)	PLASTICITY INDEX	% -200
			SURFACE ELEVATION: Existing Grade, ft					
0			**CLAYEY SAND (SC)** medium dense to loose to medium dense, brown	11				32
				6			12	
5				8				
				10				
10				30				
15			**CLAYEY SAND (SC)** very dense, brown (possibly cemented)	50/11"				
20			**LEAN CLAY with SAND (CL)** hard, brown	32				82
25				38			21	
30				50				
35				41				
40				43				
			Boring terminated at a depth of about 40 ft.					
45			NOTES: Upon completion of the drilling operations, the boring was observed dry.					

DEPTH DRILLED:	40.0 ft	**DEPTH TO WATER:**	DRY	**PROJ. No.:**	AMA24-035-00
DATE DRILLED:	7/23/2024	**DATE MEASURED:**	7/23/2024	**FIGURE:**	2

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. B-2

Prop. Hidalgo County Remote Operations Centers
8066 N. Los Ebanos Road
Mission, Hidalgo County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger

LOCATION: See Figure 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT^2	PLASTICITY INDEX	% -200
			SURFACE ELEVATION: Existing Grade, ft			0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0		
						PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT		
						10 20 30 40 50 60 70 80		
			CLAYEY SAND (SC) loose to dense, brown	10			19	
				9				44
5				6				
				11				
10				19				
15				32				43
			FAT CLAY with SAND (CH) hard, brown					
20				31			33	
25				36				
30				47				
			Boring terminated at a depth of about 30 ft.					
			NOTES: Upon completion of the drilling operations, the boring was observed dry.					
35								
40								
45								

DEPTH DRILLED:	30.0 ft	**DEPTH TO WATER:**	DRY	**PROJ. No.:**	AMA24-035-00
DATE DRILLED:	7/23/2024	**DATE MEASURED:**	7/23/2024	**FIGURE:**	3

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. P-1

Prop. Hidalgo County Remote Operations Centers
8066 N. Los Ebanos Road
Mission, Hidalgo County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger

LOCATION: See Figure 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT^2	PLASTICITY INDEX	% -200
			SURFACE ELEVATION: Existing Grade, ft			0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0		
						PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT		
						10 20 30 40 50 60 70 80		
			CLAYEY SAND (SC) medium dense to loose to medium dense, brown	11			12	
				8				
5				13				45
				12				
10			Boring terminated at a depth of about 10 ft.					
			NOTES: Upon completion of the drilling operations, the boring was observed dry.					
15								
20								
25								
30								
35								
40								
45								

DEPTH DRILLED:	10.0 ft	**DEPTH TO WATER:**	DRY	**PROJ. No.:**	AMA24-035-00
DATE DRILLED:	7/23/2024	**DATE MEASURED:**	7/23/2024	**FIGURE:**	4

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. P-2

Prop. Hidalgo County Remote Operations Centers
8066 N. Los Ebanos Road
Mission, Hidalgo County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger

LOCATION: See Figure 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT^2	PLASTICITY INDEX	% -200
			SURFACE ELEVATION: Existing Grade, ft			0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0		
						PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT		
						10 20 30 40 50 60 70 80		
			CLAYEY SAND (SC)	10				
			loose to medium desne, brown	6				44
5				7			19	
				15				
10			Boring terminated at a depth of about 10 ft.					
			NOTES: Upon completion of the drilling operations, the boring was observed dry.					
15								
20								
25								
30								
35								
40								
45								

DEPTH DRILLED:	10.0 ft	**DEPTH TO WATER:**	DRY	**PROJ. No.:**	AMA24-035-00
DATE DRILLED:	7/23/2024	**DATE MEASURED:**	7/23/2024	**FIGURE:**	5

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. P-3

Prop. Hidalgo County Remote Operations Centers
8066 N. Los Ebanos Road
Mission, Hidalgo County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger

LOCATION: See Figure 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT^2	PLASTICITY INDEX	% -200
			SURFACE ELEVATION: Existing Grade, ft			0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0		
						PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT		
						10 20 30 40 50 60 70 80		
			SANDY LEAN CLAY (CL) stiff to firm to very stiff, brown	9			14	
				8				
5				6				53
				25				
10			Boring terminated at a depth of about 10 ft.					
			NOTES: Upon completion of the drilling operations, the boring was observed dry.					
15								
20								
25								
30								
35								
40								
45								

DEPTH DRILLED:	10.0 ft	**DEPTH TO WATER:**	DRY	**PROJ. No.:**	AMA24-035-00
DATE DRILLED:	7/23/2024	**DATE MEASURED:**	7/23/2024	**FIGURE:**	6

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. P-4

Prop. Hidalgo County Remote Operations Centers
8066 N. Los Ebanos Road
Mission, Hidalgo County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger

LOCATION: See Figure 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT^2	PLASTICITY INDEX	% -200
			SURFACE ELEVATION: Existing Grade, ft			0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0		
						PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT		
						10 20 30 40 50 60 70 80		
			CLAYEY SAND (SC) medium dense to loose to medium dense, brown	13				
				8				43
5				9			16	
				25				
10			Boring terminated at a depth of about 10 ft.					
			NOTES: Upon completion of the drilling operations, the boring was observed dry.					
15								
20								
25								
30								
35								
40								
45								

DEPTH DRILLED:	10.0 ft	**DEPTH TO WATER:**	DRY	**PROJ. No.:**	AMA24-035-00
DATE DRILLED:	7/23/2024	**DATE MEASURED:**	7/23/2024	**FIGURE:**	7

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

KEY TO TERMS AND SYMBOLS

MATERIAL TYPES

SOIL TERMS

CALCAREOUS

CALICHE

CLAY

CLAYEY

GRAVEL

GRAVELLY

PEAT

SAND

SANDY

SILT

SILTY

FILL

ROCK TERMS

CHALK

CLAYSTONE

CLAY-SHALE

CONGLOMERATE

DOLOMITE

IGNEOUS

LIMESTONE

MARL

METAMORPHIC

SANDSTONE

SHALE

SILTSTONE

OTHER

ASPHALT

BASE

CONCRETE/CEMENT

BRICKS / PAVERS

WASTE

NO INFORMATION

WELL CONSTRUCTION AND PLUGGING MATERIALS

BLANK PIPE

SCREEN

BENTONITE

CEMENT GROUT

BENTONITE & CUTTINGS

CONCRETE/CEMENT

CUTTINGS

GRAVEL

SAND

VOLCLAY

SAMPLE TYPES

AIR ROTARY

GRAB SAMPLE

CORE

GEOPROBE SAMPLER

ROTOSONIC -DAMAGED

MUD ROTARY

NO RECOVERY

NX CORE

PITCHER

ROTOSONIC -INTACT

SHELBY TUBE

SPLIT BARREL

SPLIT SPOON

TEXAS CONE PENETROMETER

DISTURBED

STRENGTH TEST TYPES

POCKET PENETROMETER

TORVANE

UNCONFINED COMPRESSION

TRIAXIAL COMPRESSION UNCONSOLIDATED-UNDRAINED

TRIAXIAL COMPRESSION CONSOLIDATED-UNDRAINED

NOTE: VALUES SYMBOLIZED ON BORING LOGS REPRESENT SHEAR STRENGTHS UNLESS OTHERWISE NOTED

PROJECT NO. AMA24-035-00

KEY TO TERMS AND SYMBOLS (CONT'D)

TERMINOLOGY

Terms used in this report to describe soils with regard to their consistency or conditions are in general accordance with the discussion presented in Article 45 of SOILS MECHANICS IN ENGINEERING PRACTICE, Terzaghi and Peck, John Wiley & Sons, Inc., 1967, using the most reliable information available from the field and laboratory investigations. Terms used for describing soils according to their texture or grain size distribution are in accordance with the UNIFIED SOIL CLASSIFICATION SYSTEM, as described in American Society for Testing and Materials D2487-06 and D2488-00, Volume 04.08, Soil and Rock; Dimension Stone; Geosynthetics; 2005.

The depths shown on the boring logs are not exact, and have been estimated to the nearest half-foot. Depth measurements may be presented in a manner that implies greater precision in depth measurement, i.e 6.71 meters. The reader should understand and interpret this information only within the stated half-foot tolerance on depth measurements.

RELATIVE DENSITY

Penetration Resistance Blows per ft	Relative Density
0 - 4	Very Loose
4 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
> 50	Very Dense

COHESIVE STRENGTH

Resistance Blows per ft	Consistency	Cohesion TSF
0 - 2	Very Soft	0 - 0.125
2 - 4	Soft	0.125 - 0.25
4 - 8	Firm	0.25 - 0.5
8 - 15	Stiff	0.5 - 1.0
15 - 30	Very Stiff	1.0 - 2.0
> 30	Hard	> 2.0

PLASTICITY

Plasticity Index	Degree of Plasticity
0 - 5	None
5 - 10	Low
10 - 20	Moderate
20 - 40	Plastic
> 40	Highly Plastic

ABBREVIATIONS

B = Benzene
T = Toluene
E = Ethylbenzene
X = Total Xylenes
BTEX = Total BTEX
TPH = Total Petroleum Hydrocarbons
ND = Not Detected
NA = Not Analyzed
NR = Not Recorded/No Recovery
OVA = Organic Vapor Analyzer
ppm = Parts Per Million

Qam, Qas, Qal = Quaternary Alluvium
Qat = Low Terrace Deposits
Qbc = Beaumont Formation
Qt = Fluviatile Terrace Deposits
Qao = Seymour Formation
Qle = Leona Formation
Q-Tu = Uvalde Gravel
Ewi = Wilcox Formation
Emi = Midway Group
Mc = Catahoula Formation
El = Laredo Formation
Kknm = Navarro Group and Marlbrook Marl
Kpg = Pecan Gap Chalk
Kau = Austin Chalk

Kef = Eagle Ford Shale
Kbu = Buda Limestone
Kdr = Del Rio Clay
Kft = Fort Terrett Member
Kgt = Georgetown Formation
Kep = Person Formation
Kek = Kainer Formation
Kes = Escondido Formation
Kew = Walnut Formation
Kgr = Glen Rose Formation
Kgru = Upper Glen Rose Formation
Kgrl = Lower Glen Rose Formation
Kh = Hensell Sand

KEY TO TERMS AND SYMBOLS (CONT'D)

TERMINOLOGY

SOIL STRUCTURE

Slickensided	Having planes of weakness that appear slick and glossy.
Fissured	Containing shrinkage or relief cracks, often filled with fine sand or silt; usually more or less vertical.
Pocket	Inclusion of material of different texture that is smaller than the diameter of the sample.
Parting	Inclusion less than 1/8 inch thick extending through the sample.
Seam	Inclusion 1/8 inch to 3 inches thick extending through the sample.
Layer	Inclusion greater than 3 inches thick extending through the sample.
Laminated	Soil sample composed of alternating partings or seams of different soil type.
Interlayered	Soil sample composed of alternating layers of different soil type.
Intermixed	Soil sample composed of pockets of different soil type and layered or laminated structure is not evident.
Calcareous	Having appreciable quantities of carbonate.
Carbonate	Having more than 50% carbonate content.

SAMPLING METHODS

RELATIVELY UNDISTURBED SAMPLING

Cohesive soil samples are to be collected using three-inch thin-walled tubes in general accordance with the Standard Practice for Thin-Walled Tube Sampling of Soils (ASTM D1587) and granular soil samples are to be collected using two-inch split-barrel samplers in general accordance with the Standard Method for Penetration Test and Split-Barrel Sampling of Soils (ASTM D1586). Cohesive soil samples may be extruded on-site when appropriate handling and storage techniques maintain sample integrity and moisture content.

STANDARD PENETRATION TEST (SPT)

A 2-in.-OD, 1-3/8-in.-ID split spoon sampler is driven 1.5 ft into undisturbed soil with a 140-pound hammer free falling 30 in. After the sampler is seated 6 in. into undisturbed soil, the number of blows required to drive the sampler the last 12 in. is the Standard Penetration Resistance or "N" value, which is recorded as blows per foot as described below.

SPLIT-BARREL SAMPLER DRIVING RECORD

Blows Per Foot	Description
25	25 blows drove sampler 12 inches, after initial 6 inches of seating.
50/7"	50 blows drove sampler 7 inches, after initial 6 inches of seating.
Ref/3"	50 blows drove sampler 3 inches during initial 6-inch seating interval.

NOTE: To avoid damage to sampling tools, driving is limited to 50 blows during or after seating interval.

RESULTS OF SOIL SAMPLE ANALYSES

PROJECT NAME: Prop. Hidalgo County Remote Operations Centers
8066 N. Los Ebanos Road
Mission, Hidalgo County, Texas

FILE NAME: AMA24-035-00 MISSION.GPJ 8/19/2024

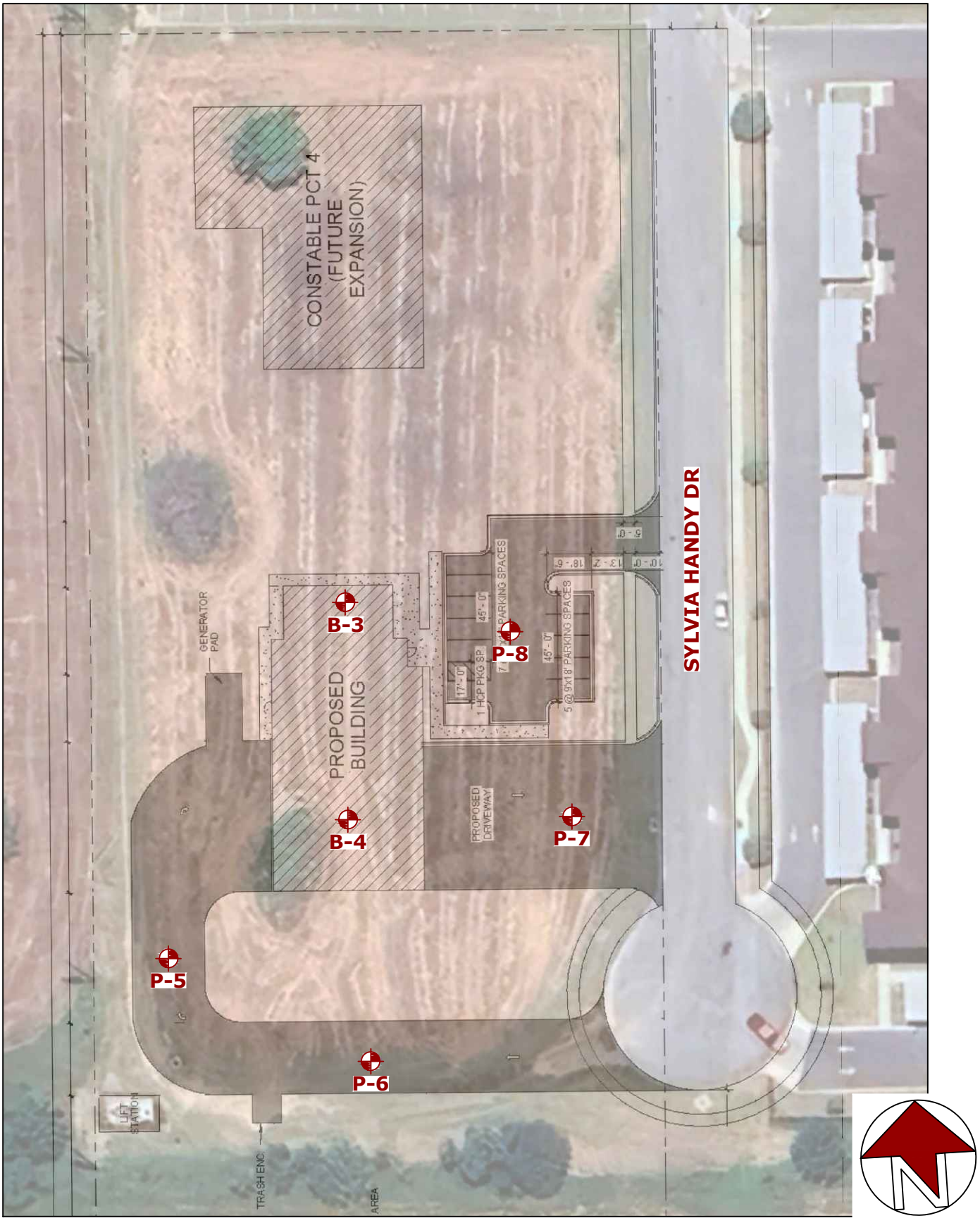
Boring No.	Sample Depth (ft)	Blows per ft	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	USCS	Dry Unit Weight (pcf)	% -200 Sieve	Shear Strength (tsf)	Strength Test
B-1	0.0 to 1.5	11	6						32		
	2.5 to 4.0	6	8	35	23	12	SC				
	5.0 to 6.5	8	11								
	7.5 to 9.0	10	16								
	10.0 to 11.5	30	19								
	15.0 to 16.4	50/ 11"	25								
	20.0 to 21.5	32	25						82		
	25.0 to 26.5	38	15	41	20	21	CL				
	30.0 to 31.5	50	16								
	35.0 to 36.5	41	18								
	38.5 to 40.0	43	18								
B-2	0.0 to 1.5	10	6	36	17	19	SC				
	2.5 to 4.0	9	7						44		
	5.0 to 6.5	6	13								
	7.5 to 9.0	11	15								
	10.0 to 11.5	19	19								
	15.0 to 16.5	32	33						43		
	20.0 to 21.5	31	15	57	24	33	CH				
	25.0 to 26.5	36	18								
	28.5 to 30.0	47	21								
P-1	0.0 to 1.5	11	5	28	16	12	SC				
	2.5 to 4.0	8	8								
	5.0 to 6.5	13	15						45		
	8.5 to 10.0	12	17								
P-2	0.0 to 1.5	10	6								
	2.5 to 4.0	6	7						44		
	5.0 to 6.5	7	14	39	20	19	SC				
	8.5 to 10.0	15	16								
P-3	0.0 to 1.5	9	7	29	15	14	CL				
	2.5 to 4.0	8	10								
	5.0 to 6.5	6	13						53		
	8.5 to 10.0	25	19								
P-4	0.0 to 1.5	13	7								
	2.5 to 4.0	8	8						43		
	5.0 to 6.5	9	13	35	19	16	SC				
	8.5 to 10.0	25	18								

PP = Pocket Penetrometer TV = Torvane UC = Unconfined Compression FV = Field Vane UU = Unconsolidated Undrained Triaxial

CU = Consolidated Undrained Triaxial CNBD = Cound Not Be Determined

PROJECT NO. AMA24-035-00

O:\Active Projects\McAllen\2024\AMA24\AMA24-035-00 Prop. Hidalgo County Remote Operations Centers-Mission, Elsa\Drawings\Figure 10.dwg



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Facilities • Infrastructure

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TBPE Firm F-3257

BORING LOCATION MAP
PROP. HIDALGO COUNTY
REMOTE OPERATIONS CENTERS

708 E. EDINBURG AVENUE
ELSA, HIDALGO COUNTY, TEXAS

REVISIONS:

No.	DATE	DESCRIPTION

PROJECT No.:	AMA24-035-00
ISSUE DATE:	08-20-2024
DRAWN BY:	DV
CHECKED BY:	AD
REVIEWED BY:	KML
FIGURE:	10

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LOG OF BORING NO. B-3

Prop. Hidalgo County Remote Operations Centers
708 E. Edinburg Avenue
Elsa, Hidalgo County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger

LOCATION: See Figure 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT²	PLASTICITY INDEX	% -200
			SURFACE ELEVATION: Existing Grade, ft			0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0		
						PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT		
						10 20 30 40 50 60 70 80		
			SANDY FAT CLAY (CH) firm to very stiff, brown, with calcareous nodules	5			26	
				21				65
5				28			31	
			FAT CLAY (CH) very stiff, brown		111			
10				20				93
15			During the drilling operations, groundwater was encountered at a depth of about 19.5 ft. Upon completion of the drilling operations, groundwater was measured at a depth of about 16.5 ft.	17				
20				22				
25			**SILTY SAND (SM)** medium dense to very dense, brown	14				
30				38				
35				50/9"				
40				50/9"				
			Boring terminated at a depth of about 40 ft.					
			NOTES:					
45			708 E. Edinburg Avenue -Elsa					

DEPTH DRILLED:	40.0 ft	**DEPTH TO WATER:**	16.5 ft	**PROJ. No.:**	AMA24-035-00
DATE DRILLED:	8/1/2024	**DATE MEASURED:**	8/1/2024	**FIGURE:**	11

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. B-4

Prop. Hidalgo County Remote Operations Centers
708 E. Edinburg Avenue
Elsa, Hidalgo County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger

LOCATION: See Figure 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT²	PLASTICITY INDEX	% -200
			SURFACE ELEVATION: Existing Grade, ft			0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 (PLASTIC LIMIT, WATER CONTENT, LIQUID LIMIT) 10 20 30 40 50 60 70 80		
0			**SANDY LEN CLAY (CL)** soft to very stiff, brown, with calcareous nodules	4				56
				9			23	
5				28				
			FAT CLAY with SAND (CH) very stiff, brown	16				78
10					111		33	
15			During the drilling operations, groundwater was encountered at a depth of about 19 ft. Upon completion of the drilling operations, groundwater was measured at a depth of about 17 ft.	20				
20				30				
25			**SILTY SAND (SM)** medium dense to dense, brown	18				
				39				
30			Boring terminated at a depth of about 30 ft.					
			NOTES:					
35			708 E. Edinburg Avenue -Elsa					
40								
45								

DEPTH DRILLED:	30.0 ft	**DEPTH TO WATER:**	17 ft	**PROJ. No.:**	AMA24-035-00
DATE DRILLED:	8/1/2024	**DATE MEASURED:**	8/1/2024	**FIGURE:**	12

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. P-5

Prop. Hidalgo County Remote Operations Centers
708 E. Edinburg Avenue
Elsa, Hidalgo County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger

LOCATION: See Figure 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT^2	PLASTICITY INDEX	% -200
			SURFACE ELEVATION: Existing Grade, ft			0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0		
						PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT		
						10 20 30 40 50 60 70 80		
			SANDY FAT CLAY (CH) soft to very stiff, brown	4			26	
				28				69
5				20				
				18				
10			Boring terminated at a depth of about 10 ft.					
			NOTES: Upon completion of the drilling operations, the boring was observed dry.					
15								
20								
25								
30								
35								
40								
45								

DEPTH DRILLED:	10.0 ft	**DEPTH TO WATER:**	DRY	**PROJ. No.:**	AMA24-035-00
DATE DRILLED:	8/1/2024	**DATE MEASURED:**	8/1/2024	**FIGURE:**	13

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. P-6

Prop. Hidalgo County Remote Operations Centers
708 E. Edinburg Avenue
Elsa, Hidalgo County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger

LOCATION: See Figure 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT^2	PLASTICITY INDEX	% -200
			SURFACE ELEVATION: Existing Grade, ft			0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0		
						PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT		
						10 20 30 40 50 60 70 80		
			SANDY LEAN CLAY (CL) soft to very stiff, brown	3				59
				22			26	
5				20				
				19				
10			Boring terminated at a depth of about 10 ft.					
			NOTES: Upon completion of the drilling operations, the boring was observed dry.					
15								
20								
25								
30								
35								
40								
45								

DEPTH DRILLED:	10.0 ft	**DEPTH TO WATER:**	DRY	**PROJ. No.:**	AMA24-035-00
DATE DRILLED:	8/1/2024	**DATE MEASURED:**	8/1/2024	**FIGURE:**	14

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. P-7

Prop. Hidalgo County Remote Operations Centers
708 E. Edinburg Avenue
Elsa, Hidalgo County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger

LOCATION: See Figure 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT^2	PLASTICITY INDEX	% -200
			SURFACE ELEVATION: Existing Grade, ft			0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0		
						PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT		
						10 20 30 40 50 60 70 80		
			SANDY LEAN CLAY (CL) firm to hard to very stiff, brown	7			20	
				20				70
5				35				
				23				
10			Boring terminated at a depth of about 10 ft.					
			NOTES: Upon completion of the drilling operations, the boring was observed dry.					
15								
20								
25								
30								
35								
40								
45								

DEPTH DRILLED:	10.0 ft	**DEPTH TO WATER:**	DRY	**PROJ. No.:**	AMA24-035-00
DATE DRILLED:	8/1/2024	**DATE MEASURED:**	8/1/2024	**FIGURE:**	15

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

LOG OF BORING NO. P-8

Prop. Hidalgo County Remote Operations Centers
708 E. Edinburg Avenue
Elsa, Hidalgo County, Texas

RABA KISTNER
TBPE Firm Registration No. F-3257

DRILLING METHOD: Straight Flight Auger

LOCATION: See Figure 1

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WEIGHT, pcf	SHEAR STRENGTH, TONS/FT^2	PLASTICITY INDEX	% -200
			SURFACE ELEVATION: Existing Grade, ft			0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0		
						PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT		
						10 20 30 40 50 60 70 80		
			SANDY LEAN CLAY (CL)	5				59
			firm to hard to very stiff, brown	20			21	
5				35				
				22				
10			Boring terminated at a depth of about 10 ft.					
			NOTES: Upon completion of the drilling operations, the boring was observed dry.					
15								
20								
25								
30								
35								
40								
45								

DEPTH DRILLED:	10.0 ft	**DEPTH TO WATER:**	DRY	**PROJ. No.:**	AMA24-035-00
DATE DRILLED:	8/1/2024	**DATE MEASURED:**	8/1/2024	**FIGURE:**	16

NOTE: THESE LOGS SHOULD NOT BE USED SEPARATELY FROM THE PROJECT REPORT

KEY TO TERMS AND SYMBOLS

MATERIAL TYPES

SOIL TERMS

CALCAREOUS

CALICHE

CLAY

CLAYEY

GRAVEL

GRAVELLY

PEAT

SAND

SANDY

SILT

SILTY

FILL

ROCK TERMS

CHALK

CLAYSTONE

CLAY-SHALE

CONGLOMERATE

DOLOMITE

IGNEOUS

LIMESTONE

MARL

METAMORPHIC

SANDSTONE

SHALE

SILTSTONE

OTHER

ASPHALT

BASE

CONCRETE/CEMENT

BRICKS / PAVERS

WASTE

NO INFORMATION

WELL CONSTRUCTION AND PLUGGING MATERIALS

BLANK PIPE

SCREEN

BENTONITE

CEMENT GROUT

BENTONITE & CUTTINGS

CONCRETE/CEMENT

CUTTINGS

GRAVEL

SAND

VOLCLAY

SAMPLE TYPES

AIR ROTARY

GRAB SAMPLE

CORE

GEOPROBE SAMPLER

ROTOSONIC -DAMAGED

MUD ROTARY

NO RECOVERY

NX CORE

PITCHER

ROTOSONIC -INTACT

SHELBY TUBE

SPLIT BARREL

SPLIT SPOON

TEXAS CONE PENETROMETER

DISTURBED

STRENGTH TEST TYPES

POCKET PENETROMETER

TORVANE

UNCONFINED COMPRESSION

TRIAXIAL COMPRESSION UNCONSOLIDATED-UNDRAINED

TRIAXIAL COMPRESSION CONSOLIDATED-UNDRAINED

NOTE: VALUES SYMBOLIZED ON BORING LOGS REPRESENT SHEAR STRENGTHS UNLESS OTHERWISE NOTED

PROJECT NO. AMA24-035-00

KEY TO TERMS AND SYMBOLS (CONT'D)

TERMINOLOGY

Terms used in this report to describe soils with regard to their consistency or conditions are in general accordance with the discussion presented in Article 45 of SOILS MECHANICS IN ENGINEERING PRACTICE, Terzaghi and Peck, John Wiley & Sons, Inc., 1967, using the most reliable information available from the field and laboratory investigations. Terms used for describing soils according to their texture or grain size distribution are in accordance with the UNIFIED SOIL CLASSIFICATION SYSTEM, as described in American Society for Testing and Materials D2487-06 and D2488-00, Volume 04.08, Soil and Rock; Dimension Stone; Geosynthetics; 2005.

The depths shown on the boring logs are not exact, and have been estimated to the nearest half-foot. Depth measurements may be presented in a manner that implies greater precision in depth measurement, i.e 6.71 meters. The reader should understand and interpret this information only within the stated half-foot tolerance on depth measurements.

RELATIVE DENSITY

Penetration Resistance Blows per ft	Relative Density
0 - 4	Very Loose
4 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
> 50	Very Dense

COHESIVE STRENGTH

Resistance Blows per ft	Consistency	Cohesion TSF
0 - 2	Very Soft	0 - 0.125
2 - 4	Soft	0.125 - 0.25
4 - 8	Firm	0.25 - 0.5
8 - 15	Stiff	0.5 - 1.0
15 - 30	Very Stiff	1.0 - 2.0
> 30	Hard	> 2.0

PLASTICITY

Plasticity Index	Degree of Plasticity
0 - 5	None
5 - 10	Low
10 - 20	Moderate
20 - 40	Plastic
> 40	Highly Plastic

ABBREVIATIONS

B = Benzene
T = Toluene
E = Ethylbenzene
X = Total Xylenes
BTEX = Total BTEX
TPH = Total Petroleum Hydrocarbons
ND = Not Detected
NA = Not Analyzed
NR = Not Recorded/No Recovery
OVA = Organic Vapor Analyzer
ppm = Parts Per Million

Qam, Qas, Qal = Quaternary Alluvium
Qat = Low Terrace Deposits
Qbc = Beaumont Formation
Qt = Fluviatile Terrace Deposits
Qao = Seymour Formation
Qle = Leona Formation
Q-Tu = Uvalde Gravel
Ewi = Wilcox Formation
Emi = Midway Group
Mc = Catahoula Formation
El = Laredo Formation
Kknm = Navarro Group and Marlbrook Marl
Kpg = Pecan Gap Chalk
Kau = Austin Chalk

Kef = Eagle Ford Shale
Kbu = Buda Limestone
Kdr = Del Rio Clay
Kft = Fort Terrett Member
Kgt = Georgetown Formation
Kep = Person Formation
Kek = Kainer Formation
Kes = Escondido Formation
Kew = Walnut Formation
Kgr = Glen Rose Formation
Kgru = Upper Glen Rose Formation
Kgrl = Lower Glen Rose Formation
Kh = Hensell Sand

KEY TO TERMS AND SYMBOLS (CONT'D)

TERMINOLOGY

SOIL STRUCTURE

Slickensided	Having planes of weakness that appear slick and glossy.
Fissured	Containing shrinkage or relief cracks, often filled with fine sand or silt; usually more or less vertical.
Pocket	Inclusion of material of different texture that is smaller than the diameter of the sample.
Parting	Inclusion less than 1/8 inch thick extending through the sample.
Seam	Inclusion 1/8 inch to 3 inches thick extending through the sample.
Layer	Inclusion greater than 3 inches thick extending through the sample.
Laminated	Soil sample composed of alternating partings or seams of different soil type.
Interlayered	Soil sample composed of alternating layers of different soil type.
Intermixed	Soil sample composed of pockets of different soil type and layered or laminated structure is not evident.
Calcareous	Having appreciable quantities of carbonate.
Carbonate	Having more than 50% carbonate content.

SAMPLING METHODS

RELATIVELY UNDISTURBED SAMPLING

Cohesive soil samples are to be collected using three-inch thin-walled tubes in general accordance with the Standard Practice for Thin-Walled Tube Sampling of Soils (ASTM D1587) and granular soil samples are to be collected using two-inch split-barrel samplers in general accordance with the Standard Method for Penetration Test and Split-Barrel Sampling of Soils (ASTM D1586). Cohesive soil samples may be extruded on-site when appropriate handling and storage techniques maintain sample integrity and moisture content.

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A 2-in.-OD, 1-3/8-in.-ID split spoon sampler is driven 1.5 ft into undisturbed soil with a 140-pound hammer free falling 30 in. After the sampler is seated 6 in. into undisturbed soil, the number of blows required to drive the sampler the last 12 in. is the Standard Penetration Resistance or "N" value, which is recorded as blows per foot as described below.

SPLIT-BARREL SAMPLER DRIVING RECORD

Blows Per Foot	Description
25	25 blows drove sampler 12 inches, after initial 6 inches of seating.
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Ref/3"	50 blows drove sampler 3 inches during initial 6-inch seating interval.

NOTE: To avoid damage to sampling tools, driving is limited to 50 blows during or after seating interval.

RESULTS OF SOIL SAMPLE ANALYSES

PROJECT NAME: Prop. Hidalgo County Remote Operations Centers
708 E. Edinburg Avenue
Elsa, Hidalgo County, Texas

FILE NAME: AMA24-035-00 ELSA.GPJ 8/19/2024

Boring No.	Sample Depth (ft)	Blows per ft	Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	USCS	Dry Unit Weight (pcf)	% -200 Sieve	Shear Strength (tsf)	Strength Test
B-3	0.0 to 1.5	5	17	53	27	26	CH				
	2.5 to 4.0	21	18						65		
	5.0 to 6.5	28	13	51	20	31	CH				
	7.5 to 9.5		19					111		1.73	UC
	10.0 to 11.5	20	20						93		
	15.0 to 16.5	17	21								
	20.0 to 21.5	22	19								
	25.0 to 26.5	14	24								
	30.0 to 31.5	38	30								
	35.0 to 36.5	50/9"	25								
	38.5 to 40.0	50/9"	22								
B-4	0.0 to 1.5	4	19						56		
	2.5 to 4.0	9	10	40	17	23	CL				
	5.0 to 6.5	28	11								
	7.5 to 9.0	16	20						78		
	10.0 to 12.0		19	56	23	33	CH	111		1.25	UC
	15.0 to 16.5	20	21								
	20.0 to 21.5	30	20								
	25.0 to 26.5	18	26								
	28.5 to 30.0	39	21								
P-5	0.0 to 1.5	4	19	56	30	26	CH				
	2.5 to 4.0	28	12						69		
	5.0 to 6.5	20	16								
	8.5 to 10.0	18	21								
P-6	0.0 to 1.5	3	18						59		
	2.5 to 4.0	22	12	41	15	26	CL				
	5.0 to 6.5	20	17								
	8.5 to 10.0	19	18								
P-7	0.0 to 1.5	7	19	37	17	20	CL				
	2.5 to 4.0	20	14						70		
	5.0 to 6.5	35	12								
	8.5 to 10.0	23	18								
P-8	0.0 to 1.5	5	18						59		
	2.5 to 4.0	20	11	38	17	21	CL				
	5.0 to 6.5	35	13								
	8.5 to 10.0	22	22								

PP = Pocket Penetrometer TV = Torvane UC = Unconfined Compression FV = Field Vane UU = Unconsolidated Undrained Triaxial

CU = Consolidated Undrained Triaxial CNBD = Cound Not Be Determined

PROJECT NO. AMA24-035-00

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GEOTECHNICAL BUSINESS COUNCIL
of the Geoprofessional Business Association

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@geoprofessional.org www.geoprofessional.org

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Corpus Christi, TX	Houston, TX	Salt Lake City, UT

SECTION 01 11 00 - SUMMARY

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 SUMMARY OF WORK

A. Project Identification: As follows:

1. Project: Hidalgo County Remote Operations Center
2. Owner: Hidalgo County
3. Location: 708 E. Edinburg Ave, Elsa, TX 78543

B. Contract Documents dated October 15, 2024 were prepared by Milnet Architectural Services, 608 S. 12th St. McAllen, TX. 78501.

C. The work consists of a new 5,780 Sq. Ft. facility for Hidalgo County which includes office spaces, meetings rooms, restrooms, a dorm, garage bays and a commercial kitchen.

1.3 WORK RESTRICTIONS

A. Contractor's Use of Premises: During construction, Contractor shall have **limited** use of **site** indicated. Contractor's use of premises is limited only by Owner's right to perform work or employ other contractors on portions of Project.

B. Assume full responsibility for the protection and safekeeping of Products under this Contract, stored on the site.

C. Move any stored Products, under Contractor’s control, which interfere with operations of the Owner and separate contractor.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 20 00 - PRICE AND PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 UNIT PRICES

A. Changes to the Work incorporating Unit Prices will be made by Change Order.

1.3 CONTRACT MODIFICATION PROCEDURES

A. On Owner's approval of a proposal from Contractor, Architect will issue a Change Order on AIA Document G701, for all changes to Contract Sum or Contract Time.

B. When Owner and Contractor disagree on the terms of a proposal, Architect may issue a Construction Change Directive on AIA Document G714, instructing Contractor to proceed with the change. Construction Change Directive will contain a description of the change and designate the method to be followed to determine changes to Contract Sum or Contract Time.

1.4 PAYMENT PROCEDURES

A. Submit a Schedule of Values **at least 10 days before** the first Application for Payment. In Schedule of Values, break down Contract Sum into at least one line item for each Specification Section. Correlate the Schedule of Values with Contractor's Construction Schedule.

B. Submit 3 copies of each application for payment on AIA Document G702/703, according to the schedule established in Owner/Contractor Agreement.

1. For the second Application for Payment through the Application for Payment submitted at Substantial Completion, submit partial releases of liens from each subcontractor or supplier for whom amounts were requisitioned in the previous Application for Payment.
2. Submit final Application for Payment after completion of Project closeout procedures with release of liens and supporting documentation. Include consent of surety to final payment and insurance certificates.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 21 00 — ALLOWANCES

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 RELATED DOCUMENTS

A. Section 01 20 00 – Price and Payment Procedures.

1.3 CONTINGENCY ALLOWANCE

A. Include in the Contract, a stipulated sum of **One Hundred Twenty-Five Thousand Dollars, ($125,000.00)** for use upon Architect's instruction.

B. Include in the Contract, a stipulated sum of **Ten Thousand Dollars, ($10,000.00)** for Landscaping and Irrigation System.

1.4 PROCEDURES FOR MANAGING ALLOWANCES

A. Contractor's costs for Products, delivery, installation, labor, payroll, taxes, bonding, and equipment rental will be included in Construction Change Directives authorizing expenditure of funds from Allowances.

B. Funds will be drawn from Allowances only by Construction Change Directives.

C. At closeout of Contract, funds remaining in Allowances will be credited to Owner by Change Order.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 25 00 – SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 SUBSTITUTION REQUIREMENTS

A. When material, article, or method is specified using name of proprietary product manufacturer, vendor, or method followed by phrase "or equal," specific item mentioned establishes basis upon which projects are to be built.

1. Other manufacturers' materials, articles, and methods not named will be considered as substitutions provided required information is submitted on “SUBSTITUTION REQUEST FORM” and will not require substantial revisions of Contract Documents.

2. This applies to specific construction methods when required by Contract Documents.

3. Substitution Requests must be filled out on enclosed “Substitution Request Form”.

B. Whenever material, article, or method is specified or described without phrase "or equal," no substitutions will be allowed.

C. Costs for redesigns due to substituted items are responsibility of Applicant.

D. In making request for substitution, Applicant/Contractor represents that he:

1. Has personally investigated proposed product or method and determined that it is equal in all respects to that specified.

2. Will provide same guarantee for substitution as for product or method specified.

3. Will coordinate installation of accepted substitution into work, making design and construction changes to complete work in all respects following the Contract Documents.

1.3 SUBMITTAL OF DATA FOR PROPOSED SUBSTITUTIONS

A. In order for substitutions that do not change design intent to be considered, submit no later than 10 days prior to bid date deadline, 3 copies of complete data set forth herein to permit complete analysis of proposed substitutions listed on submitted “SUBSTITUTION REQUEST FORM”.

1. For Products:
   a. Identification including manufacturer's name and address.
   b. Manufacturer's literature, including but not necessarily limited to:
      1) Product description, performance, and test data.
      2) Reference standards.
   c. Samples where appropriate.
   d. Name and address of similar projects on which product was used and dates of installation with contact name and telephone number.

2. For Construction Methods:
   a. Detailed description of proposed method.
   b. Drawings illustrating methods.
   c. Name and address of similar projects on which method was used and dates of use with contact name and telephone number.

3. Comparison of proposed substitution with product or method specified

4. Data relating to impact on construction schedule by proposed substitution.

5. Impact on other contracts.

1.4 APPROVAL OF SUBSTITUTION

A. Architect's decision regarding evaluation of substitutions will be final and binding.

B. All approved substitutions will be incorporated into the Contract Documents by Addendum.

PART 2 - PRODUCTS
NOT USED

PART 3 - EXECUTION
NOT USED

SUBSTITUTION REQUEST FORM

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

A/E's REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01340 Submittals
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01340 Submittals
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: Date:

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

END OF SECTION

SECTION 01 30 00 - ADMINISTRATIVE REQUIREMENTS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 PROJECT MANAGEMENT AND COORDINATION

A. Verify layout information shown on Drawings, in relation to property survey and existing benchmarks, before laying out the Work.

B. Coordinate construction to ensure efficient and orderly execution of each part of the Work.

C. Progress meetings will be held at Project site every two weeks. Notify Owner and Architect of meeting dates. Each subcontractor or other entity concerned with current progress or involved with planning or coordination of future activities, shall attend. The Contractor shall:

1. Prepare a progress meeting agenda.

2. Prepare a sign in sheet for each progress meeting.

3. Prepare minutes of each meeting and distribute to parties present.

1.3 CONSTRUCTION SCHEDULE

A. Prepare a horizontal bar-chart construction schedule. Provide a separate time bar for each activity and a vertical line to identify the first workday of each week. Use same breakdown of Work indicated in the Schedule of Values. As Work progresses, mark each bar to indicate actual completion.

1. Submit within twenty (20) days after date established for Commencement of the Work.
2. Coordinate each element with other activities. Show each activity in proper sequence. Indicate sequences necessary for completion of related Work.
3. Indicate Substantial Completion and allow time for Architect's procedures necessary for certifying Substantial Completion.
4. Schedule Distribution: Distribute copies to Owner, Architect, subcontractors, and parties required to comply with dates.

5. Updating: Revise the schedule after each meeting or activity where revisions have been made. Distribute revised copies to Owner, Architect, subcontractors, and parties required to comply with dates.

1.4 SUBMITTAL PROCEDURES

A. Coordinate submittal preparation with construction schedule, fabrication lead-times, other submittals, and activities that require sequential operations.

1. No extension of Contract Time will be authorized due to failure to transmit submittals in time to permit processing sufficiently in advance of when materials are required in the Work.
2. Architect will not accept submittals from sources other than Contractor.

B. Prepare submittals by placing a permanent label on each for identification. Provide a 4 by 5 inch space on the label or beside title block to record review and approval markings and action taken. Include the following information on the label:

1. Project name.
2. Date.
3. Name and address of Contractor.
4. Name and address of subcontractor or supplier.
5. Number and title of appropriate Specification Section.
6. Contractor's certification that materials comply with specified requirements.

C. Coordinate each submittal with other submittals and with work that does not require submittals.

D. Product Data: Mark each copy to show applicable choices and options. Include the following:

1. Data indicating compliance with specified standards and requirements.
2. Notation of coordination requirements.
3. For equipment data, include rated capacities, dimensions, weights, required clearances, and furnished specialties and accessories.

E. Shop Drawings: Submit newly prepared information drawn to scale. Do not reproduce Contract Documents or copy standard information. Submit 1 reproducible print and 1 blue- or black-line print on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches. Architect will return the reproducible print. Include the following:

1. Dimensions, profiles, methods of attachment, coordination with adjoining work, large scale details, and other information, as appropriate for the Work.
2. Identification of products and materials.
3. Notation of coordination requirements.
4. Notation of dimensions established by field measurement.
5. Identification of deviations from Contract Documents.

F. Samples: Submit Samples finished as specified and identical with the material proposed. Where variations are inherent in the material, submit sufficient units to show limits of the variations. Include product name or name of the manufacturer.

G. Architect will review each submittal, mark as appropriate to indicate action taken, and return copies less those retained. Compliance with specified requirements remains Contractor's responsibility.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 33 00 - SUBMITTALS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide shop drawings, product data, physical samples and color samples as indicated herein and in each technical section of these specifications.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Additional submittal requirements specific to the particular section of the specifications.

PART 2 - PRODUCTS

2.1 SHOP DRAWINGS

A. Prepare shop drawings using competent draftsmen, clearly and precisely showing the following:
   1. The size and gage of members.
   2. The method of anchoring and securing members of parts together.
   3. The quantity and location of each item.
   4. Other pertinent data necessary to show the Work to be done and where and how it is to be done.

B. Prepare Drawings to scale, including full size details as required to fix and illustrate the Work required. Do not use Contract Documents or reproductions thereof as shop drawing submittals.

C. Each sheet of Drawings shall be 30 x 40 inches maximum size with borders. Provide a title block in the lower right hand corner with the following information:
   1. Title of the sheet.
   2. Name and location of Project.
   3. Names of:
      a. Architect/Engineer.
      b. General Contractor.
      c. Manufacturer of the specified materials and equipment.

4. The date of the Submittal.
5. The date of each correction or revision.
6. **Submittal number including Division No.** (such as submittal no. 3 under Division 11 is numbered "11-03").

D. Fold drawings to 8-1/2x11 inch dimensions with title block exposed to top.

E. Check the Drawings and add any corrections of field measurements needed. Stamp and sign the Contractor's approval, checker's signature, and date of approval before submitting to the Architect. Shop Drawings which do not bear the Contractor's stamp or have not been reviewed by the Contractor, will be returned by the Architect without review or approval.

F. Number Shop Drawings consecutively. Indicate working and erection dimensions, arrangements, sectional views, necessary details including complete information for making connections with other Work, kinds of materials, and finishes.

G. Provide a transmittal letter in duplicate, pointing out any deviations from items, methods or named manufacturers included in the Specifications or on the Drawings. Note submittal file number including Division.

H. Submit **six (6)** blue line prints of each Shop Drawing sheet.

I. Make such corrections, changes, resubmit bound sets of Shop Drawings prints, as required herein, until approved is obtained. Any corrections or changes indicated on Shop Drawings shall not be considered as an extra work order.

2.2 PHYSICAL SAMPLES

A. Provide duplicate samples of items as specified. Samples shall be 12 inches square or 12 inches long unless noted otherwise. Minimum liquid samples shall be 1 pint. Installed materials shall match approved samples.

B. For Architect's permanent files provide one (1) 6" x 6" sample of all interior finishes, colors and materials (aluminum finish, glazing, plastic laminate, paint finish flooring materials, ceiling finish, etc.)

C. Provide a transmittal letter with each sample, listing the following:
1. Specification section title and paragraph specifying the material.
2. Name and location of Project.
3. Names of:
   a. Architect/Engineer.
   b. General Contractor.
   c. Manufacturer of the specified materials and equipment.
4. The date of the Submittal.
5. Submittal file number including Division.

D. If samples are not acceptable they will be returned directly to the Contractor for modification and resubmission.

E. If samples are acceptable, notification will be sent directly to the Contractor, and the sample retained for comparison with the complete Work.

2.3 MANUFACTURER'S PRODUCT DATA

A. Provide **six (6)** copies of pre-printed Product Data of items as specified. Carefully mark out all items not applicable to the specified item.

B. Standard catalogs, brochures, etc. including information not applicable to the project and not marked through, will be returned without review or approval.

C. Provide a transmittal letter with the Product Data from each manufacturer, listing the following information:
   1. Name and location of Project.
   2. Names of:
      a. Architect/Engineer.
      b. General Contractor.
      c. Manufacturer of the specified materials and equipment.
   3. The date of the Submittal.
   4. Submittal file number including Division.

D. If Product Data is not approved, one copy will be marked and returned directly to the Contractor for modification and resubmission.

E. If Product Data is approved, notification and one copy of the acceptable Product Data will be sent directly to the Contractor.

F. When requested by the Architect, provide six (6) copies of each ASTM Federal Specification, or other applicable documents referenced in the material Section.

PART 3 - EXECUTION

3.1 REVIEW PROCEDURE

A. Submittals will be reviewed with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the project and with the information given in the Contract Documents. Architect shall be allowed a maximum review period of **fourteen (14)** calendar days. The review of a separate item shall not indicate a review of an assembly in which the item functions. Submittals that contain excessive errors or that are incomplete will be returned without review and approval and any delay caused thereby shall be the responsibility of the Contractor.

B. If any submittals are not approved as submitted, all copies will be returned directly to the Contractor for revision. The reviewed submittals will be returned to the Contractor as soon as practicable.

C. The Contractor shall make all revisions as noted and shall resubmit the required number of corrected copies of submittals, until no exceptions are taken. The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, to revisions other than those requested on previous submissions.

D. The review of submittals shall not relieve the Contractor of responsibility for deviations from the requirements of the Contract Documents unless the Contractor has submitted, in writing, such deviations and written approval has been given to each specific deviation. The review shall not relieve the Contractor from responsibility for errors and omissions in the Shop Drawings and samples.

E. No portion of the Work requiring a submittal shall commence until the submittal has been approved as designated in the Conditions of the Contract. All such portions of the Work shall be in accordance with the submittal that has been stamped with final "Reviewed Without Exceptions" note, or "Approved" note.

F. Materials and equipment specified or approved prior to beginning the Work are required to be used on the Project. Any proposed substitution resulting from no availability of specified items must be proven "better than" by the Contractor and approved in writing by the Architect. Substitutions included in submittals shall be so noted and brought to the Architect's attention in the submittal and on the transmittal. Failure to follow this procedure will render the substitution as not acceptable whether or not reviewed by the Architect.

G. The Contractor shall have the approved shop drawings at the site at all times for use in the construction of the Work. Failure of the Contractor to supply such drawings will be deemed sufficient cause to delay the Work until such drawings are available for field use and reference.

H. For submittals that will be reviewed by one of the Architect's consultants, these submittals shall be delivered directly to the Architect. The Architect will then be responsible to provide the Consultant with a copy of the submittal.

I. For submittals that will be reviewed by one of the Architect's consultants, do not send to the Consultant as part of the package any items which will be reviewed by the Architect. As an example, do not provide a single submittal package combining Structural Steel and Miscellaneous Metal Fabrications.

END OF SECTION

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 SECTION REQUIREMENTS

A. Quality-control services include inspections, tests, and related actions including reports. Quality-control services are further specified in other Sections of these Specifications and shall be performed by independent testing agencies provided by Contractor or Owner, as specified.

1. Unless otherwise indicated, quality-control services required by authorities having jurisdiction will be provided by Owner.

B. Contractor is responsible for scheduling inspections and tests.

C. Retesting: Contractor shall pay for retesting where results of inspections and tests prove unsatisfactory and indicate noncompliance with requirements.

D. Auxiliary Services: Cooperate with agencies performing inspections and tests. Provide auxiliary services as requested. Notify agency in advance of operations requiring tests or inspections, to permit assignment of personnel. Auxiliary services include the following:

1. Access to the Work.
2. Incidental labor and facilities to assist inspections and tests.
3. Adequate quantities of materials that require testing, and assisting in taking samples.
4. Facilities for storage and curing of test samples.
5. Security and protection of samples and test equipment.

E. Duties of Testing Agency: Testing agency shall cooperate with Architect and Contractor in performing its duties. Agency shall provide qualified personnel to perform inspections and tests.

1. Agency shall promptly notify Architect and Contractor of irregularities or deficiencies observed in the Work during performance of its services.
2. Agency shall not release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.
3. Agency shall not perform duties of Contractor.

F. Submittals: Testing agency shall submit a certified written report of each inspection and test to the following:

1. Owner.
2. Architect.
3. Contractor.
4. Structural engineer.
5. Authorities having jurisdiction, when authorities so direct.

G. Report Data: Reports of each inspection, test, or similar service shall include at least the following:

1. Name, address, and telephone number of testing agency.
2. Project title and testing agency's project number.
3. Designation (number) and date of report.
4. Dates and locations where samples were taken or inspections and field tests made.
5. Names of individuals taking the sample or making the inspection or test.
6. Designation of the product and test method.
7. Complete inspection or test data including an interpretation of test results.
8. Ambient conditions at the time of sample taking and testing.
9. Comments or professional opinion on whether inspected or tested Work complies with requirements.
10. Recommendations on retesting or reinspection.
11. Name and signature of laboratory inspector.

H. Testing Agency Qualifications: Engage inspection and testing agencies that are prequalified as complying with the American Council of Independent Laboratories' "Quality Assurance Manual" and that specialize in the types of inspections and tests to be performed.

1. Each testing agency shall be authorized by authorities having jurisdiction to operate in the state where Project is located.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 50 00 — TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 SECTION INCLUDES

A. Temporary Utilities: Electricity, lighting, heat, ventilation, telephone and fax service, water, and sanitary facilities.

B. Temporary Controls: Barriers, enclosures and fencing, protection of the Work, and water control.

C. Construction Facilities: Access roads, parking, progress cleaning, project signage and temporary buildings.

1.3 TEMPORARY ELECTRICITY

A. Cost: By General Contractor. Extend temporary outlets in NEC and OSHA approved manner to facilitate construction.

B. Provide power outlets for construction operations, with branch wiring and distribution boxes located as required. Provide flexible power cords as required.

C. Provide main service disconnect and over correct protection at convenient location.

D. Provide sufficient and adequate distribution equipment, wiring, and outlets to ensure unimpeded progress of the Work.

E. Permanent convenience receptacles may be utilized during construction.

1.4 TEMPORARY LIGHTING

A. Provide and maintain lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft.

B. Provide and maintain 1 watt/sq ft lighting to exterior staging and storage areas after dark for security purposes.

C. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

D. Permanent building lighting may be utilized during construction.

E. Maintain lighting and provide routine repairs.

1.5 TEMPORARY HEAT

A. Provide and pay for heating devices and heat as needed to maintain specified conditions for construction operations.

B. Maintain minimum ambient temperature of 50 degrees F (10 degrees C) in areas where construction is in progress, unless indicated otherwise in product sections.

1.6 TEMPORARY COOLING

A. If required for the proper installation of particular materials, systems, or equipment, provide and pay for cooling devices and cooling as needed to maintain specified conditions.

1.7 TEMPORARY VENTILATION

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidify, and to prevent accumulation of dust, fumes, vapors, or gases.

B. Extend and supplement equipment with temporary fan units as required to maintain clear air for construction operations.

1.8 TELEPHONE SERVICE

A. Provide, maintain and pay for telephone service to field office.

1.9 FACSIMILE SERVICE

A. Provide, maintain and pay for separate telephone line to be used solely for fax service to field office.

1.10 TEMPORARY WATER SERVICE

A. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing as required.

1.11 TEMPORARY SANITARY

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

1.12 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas to protect existing facilities and adjacent properties from damage from construction operations and demolition. Barriers must isolate occupied use from construction activities. If and when needed, barriers must be capable of attenuating sound.

B. Provide protection for existing plant life and landscaped. Maintain plant life and landscaped areas as necessary during construction operations. Replace damaged plant life.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

D. Barrier plan and method subject to approval by the Architect and the Owner.

1.13 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6 foot high fence around construction site, equip with vehicular and pedestrian gates with locks. Fence must be capable of restricting entry by on-site facility users.

1.14 WATER CONTROL

A. Grade site to drain where additions are undertaken. Maintain excavations free of water. Provide, operate, and maintain pumping equipment and/or any other means, methods or techniques necessary to maintain excavation and site free of water.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

1.15 EXTERIOR ENCLOSURES

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protect for products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

B. Provide temporary protection of existing wall cavities, substrates, and surfaces exposed to weather during cutting and minor demolition operations to prevent entrapment of moisture and development of mildew.

1.16 PROTECTION OF INSTALLED WORK

A. Protect installed Work and provide special protection to prohibit damage and where specified in individual specification sections.

B. Provide temporary and removable protection for installed Products. Control activity in immediate work area to minimize damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic in all landscaped areas.

1.17 SECURITY

A. Provide security and facilities to protect Work and existing facilities from unauthorized entry, vandalism, or theft.

B. Coordinate project security program with Owner's existing security operations at project mobilization.

C. Maintain program throughout construction period until Owner acceptance precludes the need for Contractor security.

D. Restrict entrance of persons and vehicles into Project site and existing facilities, allowing entrance only to authorized persons and persons identified by the Contract Document and/or the Architect or Owner as authorized to visit Project site.

1.18 ACCESS

A. Provide and maintain temporary roads accessing public thoroughfares to serve construction area.

B. Extend and relocate as work progress requires. Provide detours necessary for unimpeded traffic flow.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Existing on-site roads may be used for construction traffic.

1.19 PARKING

A. Provide temporary surface parking areas to accommodate construction personnel. Existing site areas may be used if approved in advance by the Owner.

B. Contractor to propose plan for Owner concurrence and approval.

1.20 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and rubbish from site weekly and dispose off-site.

1.21 PROJECT IDENTIFICATION

A. Provide project sign. Refer to drawings for size and content.

B. Erect on site at location established by Architect.

C. No other signs are allowed without Owner permission except those required by law.

1.22 FIELD OFFICES AND SHEDS

A. Office: Weather tight with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture drawing rack, and drawing display table, phone and fax.

B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

C. Provide storage sheds and facilities to accommodate Work. Size to storage requirements for products of individual Sections, allowing for access and orderly provision for maintenance and for inspection of products to requirements of Section 01 25 00.

D. Designated existing covered and uncovered hard paved areas and facilities may be used for field storage areas. Protect and secure existing areas used for storage. Upon completion of Work, clean, repair, and restore all existing areas used for storage and restore to acceptable condition.

1.23 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials prior to Substantial Completion.

B. Remove underground installation to a minimum depth of 2 feet. Grade site to drain.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

1.2 ACTION SUBMITTALS

A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

B. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project

record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.

3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.

5. Submit test/adjust/balance records.
6. Submit sustainable design submittals required in Division 01 sustainable design requirements Section and in individual Division 02 through 33 Sections.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

a. Project name.
b. Date.
c. Name of Architect.
d. Name of Contractor.
e. Page number.

4. Submit list of incomplete items in the following format:

a. MS Excel electronic file. Architect will return annotated file.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during

construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other

foreign deposits.

c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.

d. Remove tools, construction equipment, machinery, and surplus material from Project site.

e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

g. Sweep concrete floors broom clean in unoccupied spaces.

h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.

i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.

j. Remove labels that are not permanent.

k. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

n. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.

p. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Division 01 Section "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. All concrete work, including sidewalks, exterior ramps, steps, miscellaneous concrete.

B. All form work.

C. Reinforcing steel.

D. Installation of sleeves which are furnished by plumbing, heating and electrical contractors.

E. Equipment bases are shown on architectural, mechanical, plumbing and electrical drawings.

F. Provide and install waterstop material at below grade joints.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Testing Laboratory services.

B. Excavation and fill.

C. Concrete paving, curbs, sidewalks and site concrete.

1.4 DRAWING REFERENCES: See drawings for reinforcing sizes and placement.

1.5 Submittals:

A. DESIGN MIX: Submit six (6) copies directly to the project Architect the proposed concrete mix(es). Include cement brand and type, aggregate identification, admixtures, proportions and anticipated strengths.

B. PLASTIC CHAIR SUPPORTS: Submit manufacturer's literature indicating dimensions, configurations and performance data. Submit sample for approval by the Architect. Space at a maximum of 45" centers each way. Provide closer spacing where required to prevent excessive sag, where indicated on the drawings, or to support the weight of concrete pump hose.

C. ADMIXTURES: Submit manufacturer's product data describing material and mix proportions.

D. WATERSTOPS: Submit manufacturer's product data describing material and installation procedures.

E. CURING COMPOUND: Submit Manufacturer's literature indicating composition and recommended application procedures.

F. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.6 SAMPLES

A. Plastic chair support.

1.7 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

1.8 QUALITY ASSURANCE

A. Cast-in-place concrete shall be installed by technicians specially trained in the proper handling, placing and protection of concrete and reinforcing steel. If required by the Architect, installer shall submit for approval a list of similar installations successfully completed.

B. Comply with ASTM C 94; ACI 301, "Specification for Structural Concrete"; ACI 117, "Specifications for Tolerances for Concrete Construction and Materials"; and CRSI's "Manual of Standard Practice."

C. Engage a qualified independent testing agency to design concrete mixes.

PART 2 - PRODUCTS

2.1 MATERIALS

A. GENERAL: All materials used in the Work shall be stored or handled in a manner that will prevent deterioration; any materials that have been damaged shall be immediately and completely removed from the Work. All manufactured materials, such as cement, shall be delivered and stored in their original packages that show marks or other evidence of damage shal be wholly rejected.

B. Deformed Reinforcing Bars: ASTM A 615/A 615M, Grade 60.

C. Plain Steel Wire: ASTM A 82, as drawn.

D. Steel Welded-Wire Fabric: ASTM A 185, flat sheets not rolls. Use mesh for sidewalks and equipment pads, as indicated on the drawings.

E. Portland Cement: ASTM C 150, Type I, latest edition.

F. The use of Fly Ash in the concrete mix is not acceptable.

G. Aggregates: ASTM C 33, uniformly graded.

H. Fiber Reinforcement: ASTM C 1116, Type III, synthetic fibers, 1/2 to 1 inch.

I. Air-Entraining Admixture: ASTM C 260.

J. Chemical Admixtures:
1. General: All admixtures shall be added only at the plant during mixing and must be prior approved by the Testing Laboratory. Admixtures shall comply with the requirements of ASTM C260 and C-494. Admixtures containing calcium chloride are not acceptable. Do not use admixtures in footings or seal slabs.

K. Water Stops: Flat dumbbell or center-bulb type, of either rubber (CRD C 513) or PVC (CRD C 572).

L. **Vapor Barrier: Reference Spec Section 07 26 16 Under Slab Vapor Barrier.**

M. Liquid Membrane-Forming Curing Compound: ASTM C 309, clear, Type I, Class A or B, solvent borne, wax free.

N. Liquid Membrane-Forming Curing and Sealing Compound: ASTM C 1315, clear, Type I, Class A, solvent borne.

O. Slip-Resistive Aggregate: Factory-produced, rustproof, nonglazing, fused aluminum-oxide granules or crushed emery, unaffected by freezing, moisture, and cleaning materials.

P. Joint-Filler Strips: ASTM D 1751, cellulosic fiber, or ASTM D 1752, cork.

Q. Repair Underlayment: Factory-packaged, portland or blended hydraulic cement-based, polymer-modified, self-leveling underlayment with minimum 28-day compressive strength of 4100 psi (29 MPa).

R. Repair Topping: Factory-packaged, portland or blended hydraulic cement-based, polymer-modified, self-leveling traffic-bearing topping with minimum 28-day compressive strength of 5700 psi (39 MPa).

2.2 MIXES

A. Proportion normal-weight concrete mixes to provide the following properties:

1. Compressive Strength:
   a. Ramps and sidewalks: 3000 psi at 28 days.
2. Slump Limit: 5 inches at point of placement.
3. Air Content: 5.5 to 7.0 percent for concrete exposed to freezing and thawing, 2 to 4 percent elsewhere.

2.3 FORMWORK

A. GENERAL: Forms shall conform to the shapes, lines, grade and dimensions of the concrete as indicated in the drawings. Lumber used in forms for exposed surfaces shall be dressed to a uniform thickness and shall be free of loose knots or other defects. Lumber once used in forms shall be thoroughly cleaned before another usage. Form **full depth** of outside face of perimeter grade beams without horizontal joints or

cracks. Forms shall be substantial and sufficiently tight to prevent leakage. They shall be properly shored, braced or otherwise tied or supported to maintain the desired position and shape during and after placement of concrete. Use no formwork which may stain exposed concrete surfaces.

B. FORM LINING: For exposed concrete the final finish shall be smooth, even and free of defects.

C. FORM REMOVAL: Forms shall remain in place sufficient time for the concrete to obtain necessary strength to support its own weight and construction load.

PART 3 - EXECUTION

3.1 CONCRETING

A. Construct formwork and maintain tolerances and surface irregularities within ACI 117 limits of Class A for concrete exposed to view and Class C for other concrete surfaces.

B. Set water stops where indicated to ensure joint water tightness.

C. Place vapor retarder on prepared subgrade, with joints lapped 6 inches (150 mm) and sealed.

D. Accurately position, support, and secure reinforcement.

E. Install construction, isolation, and contraction joints where indicated. Install full-depth joint-filler strips at isolation joints.

F. Place concrete in a continuous operation and consolidate using mechanical vibrating equipment.

G. Protect concrete from physical damage, premature drying, and reduced strength due to hot or cold weather during mixing, placing, and curing.

H. Formed Surface Finish: Smooth-formed finish for concrete exposed to view, coated, or covered by waterproofing or other direct-applied material; rough-formed finish elsewhere.

I. Slab Finishes: Float finish for ramps and surfaces to receive waterproofing or other direct-applied material. Trowel and fine-broom finish for surfaces to receive thin-set tile. Nonslip-broom finish to exterior concrete platforms, steps, and ramps.

J. Uniformly spread 25 lb/100 sq. ft. (12 kg/10 sq. m) of dampened slip-resistive aggregate over initially floated surfaces; tamp and float. Expose nonslip aggregate after curing.

K. Uniformly spread 100 lb/100 sq. ft. (49 kg/10 sq. m) of mineral dry-shake floor hardener over initially floated surfaces, repeat float finishing to embed each application, and then apply a trowel finish.

L. Cure formed surfaces by moist curing for at least seven days.

M. Begin curing concrete slabs after finishing.

N. Owner will engage a testing agency to perform field tests and to submit test reports.

O. Protect concrete from damage. Repair surface defects in formed concrete and slabs.

P. Repair slabs not meeting surface tolerances by grinding high areas and by applying a repair underlayment to low areas receiving floor coverings and a repair topping to low areas to remain exposed.

3.2 CLEANING AND PROTECTION

A. CLEANING: Slabs are to be kept free of any foreign substances (wax, oil, paint, etc.) or surface irregularities that may affect the final appearance of the completed installation.

B. Unless otherwise approved by the Architect, no vehicular traffic will be allowed on any concrete until after the 7 day concrete tests have been made by the laboratory indicating that the concrete has attained 3,000 psi compressive strength.

C. Contractor shall coordinate with Architect and Owner to determine a suitable on-site “wash-out” area for concrete trucks. Contractor shall be responsible for clean-up of the area.

D. Contractor shall keep clean all adjacent public streets and rights of way. Wash down daily or more often as needed to remove mud and maintain a safe condition at entrances/exits to job site.

END OF SECTION

SECTION 03 50 00 - CONCRETE FLOOR FINISHING

PART 1 – GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 SUMMARY

A. This Section includes the following:

1. Finishing slabs-on-grade, monolithic floor slabs, and separate floor toppings.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for concrete slab construction and finish and concrete topping slabs.
2. Division 7 Section “Joint Sealers”

1.2 REFERENCES

A. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise.

1. ACI 301 - Specifications for Structural Concrete for Buildings
2. ACI 302 - Guide for Concrete Floor and Slab Construction
3. ASTM E1155 - Determining Floor Flatness and Levelness Using the F-Number System (Inch-Pound Units).

1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

B. Submittals

1. Product Data: Submit manufacturer's data showing compliance with the specifications for the following products:

a. Sealer

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage, mixing with other components, and application.

B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2.2 RELATED MATERIALS

A. Semi rigid Joint Filler: Two-component, semi rigid, 100 percent solids, epoxy resin with a Type A Shore durometer hardness of 80 per ASTM D 2240.

B. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

C. Saw cut joint filler: Euco 700 epoxy by The Euclid Chemical Company, or approved equal.

PART 3 - EXECUTION

3.1 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Concrete slabs shall be finished as specified below, within the tolerances specified elsewhere in this Section.

1. Highway straightedges are recommended for use in lieu of bull floats for all slab placement and finishing operations.
2. Screeding: Immediately after placing, slab shall be vibrated and struck off true by double screeding to the required level, at or below the elevation or grade of the finished slabs as indicated on the Drawings. Vibrators shall not be used to spread the concrete. When camber is indicated for slabs supported on formwork, screed to the required camber. Fixed screed guides are recommended where specified surface tolerance exceeds FF25/FL20.
3. Floating: Immediately after screeding, before any excess bleed water is present on the surface, float the surface using long-handled bull floats or darbies.

4. Straightedging: Immediately after screeding and before excess bleed water is present on the surface, straighten the surface using a highway straightedge.
5. Edging and jointing, where required, shall be done after bleed water has evaporated and before further finishing.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.
2. Locations: All concrete surfaces under waterproofing membrane, setting beds for brick, mud-set tile, pavers, or terrazzo, and noncomposite topping slabs.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film- finish coating system.
2. Locations: Exposed concrete floors not otherwise specified, concrete surfaces under carpets, vinyl tile, thin set tile, wood flooring, elastomeric coatings, and painted concrete floors, and roof slabs that are future floors.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.2 FINISHING CONCRETE TOPPING SLABS

A. Place concrete floor topping continuously in a single layer, tamping and consolidating to achieve tight contact with bonding surface. Do not permit cold joints or seams to develop within pour strip.

1. Screed surface with a straightedge and strike off to correct elevations.
2. Slope surfaces uniformly where indicated.
3. Begin initial floating using bull floats to form a uniform and open-textured surface plane free of humps or hollows.

B. Finishing: Consolidate surface with power-driven floats as soon as concrete floor topping can support equipment and operator. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until concrete floor topping surface has a uniform, smooth, granular texture.

1. Provide floor finish as described above.

a. Finish surfaces to specified overall values of flatness, F(F) 25; and levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and levelness, F(L) 15, and notify independent testing agency to permit measurement within 24 hours according to ASTM E 1155 for a randomly trafficked floor surface.

b. Finish and measure surface so gap at any point between surface and an unleveled freestanding 10-foot-long straightedge, resting on 2 high spots and placed anywhere on the surface, does not exceed 1/4 inch.

3.3 CONTROL JOINTS IN TOPPING SLABS

A. Saw-cut Control Joints with Soff-Cut saw: After completion of finishing operation, cut control joints using a "Soff-Cut" brand electric saw along straight lines where called for on the Drawings. Follow manufacturer's instructions in using "Soff-Cut" saw. Sawcutting shall be done within 2 hours after the completion of finishing, but not so soon as to cause raveling of the joint. Cut to depth indicated on the Drawings.

1. After completion of finishing operations, cut control joints along straight lines where called for on the Drawings. Saw cutting shall be done within 4 hours after the completion of finishing, but not so soon to cause raveling of the joint. Cut to the depth indicated on the Drawings.

B. Form joints in concrete topping slabs at 8’-4” o.c. max.

C. Construct control joints for a combined depth equal to ¼ the topping thickness.

3.4 JOINT FILLING

A. Prepare, clean, and install joint filler per manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semi rigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

1. Install joint-filler strips in lengths if practicable. Where more than one length is required, lace or clip sections together.

3.5 CONCRETE FINISH MEASUREMENT AND TOLERANCES

A. All floors are subject to measurement for flatness and levelness and shall comply with the following:
   1. Measurement Standard: All floors are subject to measurement for flatness and levelness, according to ASTM E1155, "Standard Test Method for Determining Floor Flatness and Levelness Using the F-Number System."

B. Two-Tiered Measurement Standard: Each floor test section and the overall floor area shall conform to the two-tiered measurement standard as specified herein.

   1. Minimum Local Value: The minimum local FF/FL values represent the absolute minimum surface profile that will be acceptable for any one test sample (line of measurements) anywhere within the test area.
   2. Specified Overall Value: The specified overall FF/FL values represent the minimum values acceptable for individual floor sections as well as the floor as a whole.

C. Floor Test Sections

   1. A floor test section is defined as the smaller of the following areas:

      a. The area bounded by column and/or wall lines.
      b. The area bounded by construction and/or control joint lines.
      c. Any combination of column lines and/or control joint lines.

   2. Test sample measurement lines within each test section shall be multidirectional along two orthogonal lines, as defined by ASTM E1155, at a spacing to be determined by the Owner's testing agency.
   3. The precise layout of each test section shall be determined by the Owner's testing agency.

D. Concrete Floor Finish Tolerance

   1. The following values apply before removal of shores. Levelness values (FL) do not apply to intentionally sloped or cambered areas, nor to slabs poured on metal deck or precast concrete.

      a. Typical:

Overall Value	FF25/FL20
Minimum Local Value	FF17/FL15

E. Floor Elevation Tolerance Envelope:

   1. The acceptable tolerance envelope for absolute elevation of any point on the slab surface, with respect to the elevation shown on the Drawings, is as follows:

      a. Slab-on-Grade Construction: +/- 3/4"
      b. Top surfaces of formed slabs measured prior to removal of supporting shores: +/- 3/4"
      c. Top surfaces of all other slabs: +/- 3/4"

d. Slabs specified to slope shall have a tolerance from the specified slope of 3/8" in 10'-0" at any point, up to 3/4" from theoretical elevation at any point.

3.6 FIELD QUALITY CONTROL

A. Concrete Floor Flatness and Levelness:

1. Measurement Standard: Floors shall be measured for flatness and levelness according to ASTM E1155, "Standard Test Method for Determining Floor Flatness and Levelness Using the F-Number System." Tolerances are specified in Section 03 30 00.
2. Time Period for Measuring and Reporting: All measurements shall be made by the testing laboratory or designated agency before the end of the next workday after the completion of finishing operations. For structural elevated floors, measurement shall also be made prior to removal of forms and shores. The Contractor shall be notified immediately after the measurements of any section are complete, and a written report of the floor measurement results shall be submitted within 72 hours after finishing operations are complete. The Contractor shall take immediate action to correct any work that is outside the specified tolerances.
3. Measuring Equipment: The concrete surface profile shall be measured using equipment manufactured for the purpose, such as the Dipstick Floor Profiler, as manufactured by the Edward W. Face Company, Norfolk, Virginia, or by other methods specified in ASTM E1155.
4. Floor Test Sections:

    a. A floor test section is defined as the smaller of the following areas:

        1) The area bounded by column and/or wall lines.
        2) The area bounded by construction and/or control joint lines.
        3) Any combination of column lines and/or control joint lines.

    b. Test sample measurement lines within each test section shall be multidirectional along two orthogonal lines.
    c. The precise layout of each test section shall be determined by the testing agency and shall be submitted for the Architect's review and approval.

3.7 REPAIRS

A. Defective Topping: Repair and patch defective concrete floor topping areas, including areas that have not bonded to concrete substrate.

B. Remedial Measures for Slab Finish Construction Not Meeting Specified Tolerances:

1. Application of Remedial Measures. Remedial measures specified herein are required whenever either or both of the following occur:

    a. The composite overall values of flatness or levelness of any test section or the entire floor installation measure less than specified values.

b. Any individual test sample (line of measurements) measures less than the specified absolute minimum flatness or levelness value.

2. Modification of Existing Surface:

a. If, in the opinion of the Architect or Owner's representative, all or any portion of the substandard work can be repaired without sacrifice to the appearance or serviceability of the area, the Contractor shall immediately undertake the approved repair method.
b. The Contractor shall submit for review and approval a detailed work plan of the proposed repair showing areas to be repaired, method of repair, and time required to make the repair.
c. Repair method(s), at the sole discretion of the Architect or Owner's Representative, may include grinding (floor stoning), planing, retopping with specified floor leveling compound, or any combination of the above.
d. All repair work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.

3. Removal and Replacement:

a. If, in the opinion of the Architect/Engineer or Owner's Representative, all or any portion of the substandard work cannot be satisfactorily repaired without sacrifice to the appearance or serviceability of the area, the Contractor shall remove and replace the defective work as directed.
b. Replacement sections may be retested for compliance at the discretion of the Architect/Engineer or Owner's Representative.
c. All replacement work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.

END OF SECTION

SECTION 04 05 13 — MORTAR

PART 1 - GENERAL

1.01 COORDINATION

A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.02 SCOPE:

A. Perform all work required to furnish the Masonry Mortar indicated by the Contract Documents and furnish all supplementary items necessary for its proper installation.

B. The requirements of Division 0 – “Bidding and Contract Requirements” and Division 1 – “General Requirements” of this Project Manual shall apply to all Work required for this Section.

C. Application of Mortar used in the installation of masonry units is specified in each respective Unit Masonry Section and is not included in the work required for this Section.

1.03 SUBMITTALS:

A. Submit product data on all mortar and admixtures.

B. Submit certification that mortar and grout material meet ASTM standards.

1.04 PRODUCT DELIVERY AND STORAGE:

A. Delivery: Delivery materials to Project site dry and in unbroken containers.

B. Storage: Store materials above ground in waterproof shelters.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Material manufactured by any of the following manufacturers is acceptable, provided it complies with the Contract Documents.

1. PORTLAND CEMENT:
   a. Capitol — Lone Star
   b. Trinity — Texas Industries

c. Universal Atlas Cement

2. LIME:
   a. Gibsonburg Lime Products Co., Tiger Limes
   b. Texas Lime Company
   c. United States Gypsum Company
   d. National Gypsum Company

3. WATER PROOFING ADMIXTURE:
   a. Master Builders-Omicron Mortarproofing
   b. Sonneborn Building Products-Hydracide
   c. W.R. Grace-Hydratite Plus

4. MORTAR COLOR:
   a. Gray-

5. DRY BLOCK-One pound per cubic foot of cementitious material, ½ sack per sack of 2 sacks of cement fluted, split –face CMU for warranty purposes

B. Refer to Section 01 25 00 - Substitutions Procedures for manufacturers not listed above.

2.02 MATERIALS:

A.	Portland Cement:	ASTM C150, TYPE I.
B.	Hydrated Lime:	ASTM C207, TYPE S.
C.	Fine Aggregate:	ASTM C144,
D.	Coarse Aggregate:	ASTM C404, Size No. 8
E.	Water:	Clean and free of deleterious acids, alkalies, or organic matter.
F.	Waterproofing Admixture:	Omicron Mortarproofing, manufactured by Master Builders.
G.	Grout Admixture:	“Fluidifier” by Master Builders.
H.	Sealer:	“DEFY” Block Water Repellant

2.03 PROPORTIONS AND MIXING:

A. Meet requirements of ASTM C270 and proportion mortar types as specified.

B. Meet requirements of ASTM C476 for masonry grout and proportion grout type as specified.

C. Proportion material accurately and mix thoroughly by machine to a uniform consistency and color. Mix mortars with the maximum amount of water consistent with workability.

D. Do not use mortar that has begun to set. Retemper mortar by adding water if mortar begins to stiffen from evaporation or absorption of a part of the mixing water. Use and place mortar in final position within 2-1/2 hours after mixing.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. See specific section of Masonry Materials for installation instructions.

3.02 MORTAR SCHEDULE:

A. Exterior Masonry Walls:
   1. Mortar-Type S, ASTM C270.
   2. Waterproofing Admixture-***dry block required to provide warranty.***

B. Interior Masonry Partitions:
   1. Mortar-Type N, ASTM C270.

C. Interior Paving Tile:
   1. Mortar-Type S, ASTM C270.

D. Exterior Paving Tile:
   1. Mortar-Type M, ASTM C270.

3.03 GROUT SCHEDULE:

A. Paving Tile:
   1. Portland Cement-one part.
   2. Fine Aggregate-three parts.
   3. No lime.
   4. Sealer

END OF SECTION

SECTION 04 21 13 — THIN BRICK MASONRY

PART 1 - GENERAL

1.1 COORDINATION:

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 SUBMITTALS:

A. Within fifteen (15) calendar days after awarded of contract submit the following:

(1) Submit technical data for each type of masonry wall reinforcement, anchors, and ties.

(2) Submit sample panel of brick specified showing full color range.

1.3 MOCKUP:

A. Lay up, where directed at Site, mock-up panel 4 feet high by 6 feet wide using range of brick selected for facing and mortar specified.

B. **Do not proceed** with brickwork on Project until sample panel has been approved for color and shading. Approved panel shall be the standard of comparison for workmanship and materials. Do not destroy, alter, or move panel until brickwork is completed.

1.4 STORAGE AND HANDLING:

A. Handle materials in manner to prevent breakage and chipping.

B. Store materials on platforms raised free of the ground and protect materials with tarpaulin covers.

1.5 EVIROMENTAL CONDITIONS:

A. Do not lay brick when the temperature of the outside air is 40˚F or less, or will fall below 40˚F twenty – four (24) hours after laying.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Material manufactured by any of the following manufacturers is acceptable provided it complies with the Contract Documents.

REINFORCEMENT, ANCHORS AND TIES:

1. AA Wire Products Company
2. Duro-O-Wall
3. Heckmann Building Products, Inc.
4. Hohmann and Barnard, Inc.
5. Masonry Reinforcing Corp. of America
6. National Wire Products Corp.

2.2 MATERIALS

A. MANUFACTURERS:

1. Hanson Brick Co.
2. Acme Brick Co.
3. Brick Selections

B. Type: Comply with ASTM C-216, Grade SW, Type FBS for face brick. Comply with ASTM C902-87 for brick pavers. Provide letter for compliance from brick manufacturer or supplier.

C. Shapes: Provide any special molded shapes required or as may be indicated in the drawings. All outside face brick corners other than 90˚ shall require shaped brick. All outside corners for soldier courses shall require shaped brick. Job cutting face brick shall not be acceptable where cut face is exposed. Provide shop drawings for Architect's approval.

D. Solids: Provide solids as required to ensure against exposed cores or unfinished face on ends.

E. Size: Modular (3/4" x 7-5/8" x 3-5/8") and as indicated in the drawings.

F. Selections:

- Brick Color, Field Color: Color to be selected by Architect.
- Brick Color, Accent #1: Color to be selected by Architect.
- Capstone, Accent #2: Color to be selected by Architect.

G. CORRUGATED METAL TIES: DUR-O-WAL D/A 518 adjustable wall tie. Tie number as recommended by manufacturer for overall wall thickness. Zinc coating – 1.50 oz. per sq. ft. of uncoated wire surface – ASTM A 153- Class B-2.

H. CLEANING AGENT: TRISODIUM PHOSPHATE (Calgon) and household detergent.

I. WATER: Clean and free of deleterious acids, alkalies, or organic materials.

J. CONTROL JOINT SPACER: As specified in the CONCRETE MASONRY Section.

K. PREMOLDED NEOPRENE PAD: ASTM D – 1056SCE-43, R431-N by RUBTEX CORP., 3” wide, by 1/8” thick.

L. WEEPS: Plastics tubes, 3/8” diameter, AA Wire Products Co., AA223.

M. REINFORCING BARS: ASTM A615, Grade 60 deformation per ASTM A305, number 4 bars unless otherwise indicated.

N. MORTAR SCREENS: #84 Weep thru mortar deflector by Heckmann Building Products.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Provide, install and maintain all scaffolding, staging and forms of protection necessary for execution of the work; substantially constructed, maintained, moved and dismantled as required to properly follow the sequence of the operation.

B. Provide and install all shores and centering for the work, constructed true to required shape, size and form, well braced and made rigid in all parts, and capable of supporting and sustaining the loads to which subjected.

C. Leave all shores and centering in place until the masonry has sufficiently set to safety carry its own weight and added loads of construction. Shore all free standing wall until protected from damage by windstorm.

D. Examine surfaces to receive masonry and report and discrepancies before commencing work. Accept no former measurements, but layout work according to the plans and figures thereon.

3.2 ADJUSTING

A. All brick having absorption rates determined in accordance with ASTM C67 in excess of 0.025 oz. per sq. ft. inch per minute shall be wetted sufficiently so that the rate of absorption when laid does not exceed this amount. Wetting shall be such as to insure that each unit is nearly saturated, surface dry when laid.

B. Lay brick plumb, level and true to a line running bond or as indicated. Lay 3 courses to 8” vertically with uniform horizontal and vertical joints. Glaze brick and tile shall be laid stack bond

C. Lay brick in full bed or mortar with head and edge joints completely filled. Spread mortar for bed joint only so far ahead of laying units that the mortar will be plastic when units are laid. Butter end of brick for head joints with ample mortar so the vertical joint is completely filled with mortar when brick is shoved into place.

D. Rock closures into place with both head joints and closure space spread with ample mortar. Shove against the two adjacent bricks in place so that both horizontal and vertical joints are completely filled. Do not disturb previously laid brick.

E. Avoid over-plumbing and pounding of the corner and jambs to fit stretcher units after setting in place. Where adjustments must be made after initial setting, remove mortar and replace with fresh mortar.

F. Fill the vertical, longitudinal joint between brick and backup as the course is laid, by pouring or slushing the vertical joint full or grout with the same mortar as used for setting.

G. Keep cavity clear by laving a board, ¾" x cavity width, across a level of the ties to catch the droppings. As masonry reaches the next level for placing ties, raise the board, clean it and lay it on ties at that level.

H. Finish joints that will remain exposed with a tool slightly larger that he width of the joint, to form a concave surface. Tool joints after the mortar has taken its initial set and in such manner as to squeeze the mortar back into the joint. Tool vertical joint first.

I. Fill all nail or line-pipe holes with fresh mortar immediately upon removal. Provide weeps in head joints 16" on centers, in first horizontal course above flashings. Keep cavity side of weep free from mortar or accumulated materials.

J. Cut brick, where necessary for fitting or bonding, with a power saw to insure straight, evenly cuts edges.

K. Cover tops of walls at end of day's work and when rain or is imminent with waterproof membrane. Overhang two feet on each side of wall and anchor securely. Protect masonry from weather or construction damage.

L. Stop off longitudinal run of masonry where absolutely necessary by racking one-half length in each course. Remove loose mortar before new work is started and slightly wet old work.

3.2 ANCHORING:

A. Space anchors not over 16" on center vertically and 24" on centers horizontally. Locate anchors at vertical and horizontal supports, and at other locations as indicated.

B. Bond brick to backup with adjustable wall ties and joint reinforcing installed in adjacent masonry.

C. Maintain a minimum of ½" clearance between masonry and concrete or steel structure. Keep space free of mortar and other rigid material.

3.3 CONTROL AND EXPANSION JOINTS:

A. Locate expansion joints where they occur in backup material. Locate control joints no to exceed 25'-0" on center. Keep vertical joints straight, true and continuous from top to bottom of masonry. Verify locations of control joints with Architect.

B. Keep joints clean of mortar as work progresses. Build-in control joint spacer at control joints and flashings at expansion joints

3.4 EMBEDDED ITEMS:

A. Build in flashings, sleeves, anchors, clips and accessories as work progresses. Install loose lintels, as indicated, in full beds of mortar.

3.5 CLEANING:

A. Keep face of brickwork free excess mortar while laying brick. Brush with dry fiber brush prior to wet cleaning.

B. Clean brickwork that will remain exposed promptly with fiber brushes, clean water and cleaning agent. Use or wire brushes, commercial cleaner or acid permitted only with specific approval.

C. Repair and repoint defective work. Replace broken, damaged or discolored brick.

D. Pressure wash all exterior brick work prior to Owner occupying new building.

END OF SECTION

SECTION 04 22 00 — CONCRETE MASONRY UNIT

PART 1 - GENERAL

1.01 COORDINATION

A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.02 SCOPE:

A. Perform all Work required to complete the Concrete Unit Masonry indicated by the Contract Documents and furnish all supplementary items necessary for its proper installation.

B. The requirements of Division 0 – “Bidding and Contract Requirements” and Division 1 – “General Requirements” of this Project Manual shall apply to all Work required for this Section.

1.03 PRODUCTS INSTALLED UNDER THIS SECTION BUT SPECIFIED ELSEWHERE:

A. Section 04 05 13 – Mortar.

B. Section 07 92 00 – Sealants and Caulking.

1.04 SUBMITTALS:

A. Submit technical data for each type wall reinforcement, anchors and ties.

B. Submit 12” long sample of control joint filler.

C. Submit certificate that masonry units conform to ASTM and NBFU standards specified.

1.05 STORAGE AND HANDLING:

A. Handle materials in a manner to prevent breakage and chipping. Store materials on platforms raised free of ground and protect materials with stainproof tarpaulin covers.

1.06 ENVIRONMENTAL CONDITIONS:

A. Lay no masonry when the temperature of the air is 40°F. twenty-four (24) hours after laying. Do not build on frozen work.

B. Store masonry units on the job so that they are kept off the ground and protected from rain.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Material manufactured by any of the following manufacturers is acceptable, provided it complies with the Contract Documents.

1. REINFORCEMENT, ANCHORS AND TIES:

Duro-O-Wal	AA Wire Products Company
Heckman Build Products, Inc.	Hohmann and Barnard, Inc.
Masonry Reinforcing Corp. of America	National Wire Products Corp.

2. SPLIT FACE BLOCK SEALER:
"DEFY" Split Face Block Water Repellant

2.02 MATERIALS:

A. UNITS:
1. Hollow Concrete Masonry: ASTM C90, medium weight, Grade N-1

B. REINFORCEMENT:
1. Block Wall Joint Reinforcement:
ASTM A82, AA Wire Products Co., "BLOK-TRUS", AA600 two wire, width 2" less than wall thickness, standard weight galvanized ASTM A116, Class 1.
2. Lintel and Bond Beam Reinforcement: Domestic, ASTM A615, or ASTM A616, deformations ASTM A305. Unless otherwise shown on drawings provide 2-#4 Ø cont. lap 30 dias.

C. WATER: Clean and free of deleterious acids, alkalies or organic material.

D. Bullnose edge at all masonry corners for interior walls. Provide sealer for all exterior split face c.m.u.

PART 3 - EXECUTION

3.01 CONDITION OF SURFACES:

A. Do not commence with masonry work until foundation has properly cured a minimum of seven (7) days and reinforcing steel that is dowelled for masonry units has been approved.

B. Consult other trades and make provisions to permit installation of their work to avoid cutting and patching. Before closing up any pipe chase, or similar inaccessible spaces, remove all rubbish and sweep out areas to be enclosed.

3.02 PREPARATION:

A. Provide, install and maintain all scaffolding, staging and forms of protection necessary for execution of the work; substantially constructed, maintained, moved and dismantled as required to properly follow the sequence of operation.

B. Provide and install all shores and centering for the work, constructed true to require shape, size and form; well-braced and made rigid in all parts, and capable of supporting and sustaining the loads to which subjected.

C. Leave all shores and centering in place until the masonry has sufficiently set to safely carry its own weight and the added loads of construction. Shore free-standing walls to prevent windstorm damage until walls are protected.

D. Examine surfaces to receive masonry and report any discrepancies before commencing work. Accept no former measurements, but lay work according to the plans and dimensions thereon.

3.03 LAYING CONCRETE MASONRY UNITS:

A. Do not dampen units before laying, and do not lay units which have surface water or contain frost. Lay units plumb, level, and true to a line in running bond, or as indicated. Align on exposed face or as indicated.

B. Lay first course of masonry in full bed of mortar. Lay all other hollow units in a full mortar bed on shell surface and at ends.

C. Lay hollow units with the thicker edge of the face shell up and make all joints 3/8” thick. Lay corners prior to laying mid-portion of wall. Rock closures into place with the head joints shoved against the two adjacent units in place.

D. Cut units with power saw through the unit to insure straight, evenly cut edges. Do not use fractional parts of masonry units in the work where whole units can be used.

E. Avoid over-plumbing and pounding of the corners and jambs to fit stretcher units after setting in place. Remove mortar and replace with fresh mortar where adjustment must be made after initial settings.

F. Do not use masonry units having cracks, chipped edges, broken corners or other defects in exposed faces. Build walls full thickness as shown. Blocks with open cells exposed will not be permitted.

G. Provide all special precast lintels, fillers, closers, control joint units, trough tile, etc., required to form all corners, returns, openings, jambs, offsets, etc., to maintain a proper bond throughout all masonry work.

H. Protect all sills, ledges, off-sets, etc., from droppings of mortar and protect door jambs and corners from damage during construction.

I. Stop off longitudinal run of masonry only where absolutely necessary by racking one-half block length in each course. Remove loose mortar before new work is started.

J. Cover tops of walls at end of day’s work and when rain is imminent, with waterproof membrane. Overhang two feet on each side of wall and anchor securely. Protect masonry from weather or construction damage.

3.04 JOINTS:

A. Mortar joints shall be straight, clean and uniform in thickness. Tool joints of all walls to produce a dense surface well bonded to the edges. Joints which are not tight at the time of tooling shall be raked out, pointed, and then tooled.

B. Tool when the mortar is partially set but still sufficiently plastic to bond. Use a tool which compacts the mortar, pressing the excess mortar out of the joint rather than dragging it out.

C. Finish joints that will remain exposed with a tool slightly larger than the width of the joint to form a concave surface. Tool vertical joint first. Finish flush, joint that will not remain exposed.

D. Unless otherwise specified the horizontal and vertical mortar joints shall be 3/8” thick with full mortar coverage on the face shells and on the webs surrounding cells to be filled with grout.

E. Vertical head joints shall be buttered well for a thickness equal to the face shell of the unit and these joints shall be shoved tightly so that the mortar bonds with both units. Joints shall be solidly filled from the face of the block to at least the depth of the face shell.

3.05 REINFORCING:

A. Install continuous joint reinforcing 16” on centers for running bond. Install joint reinforcing in the first and second bed joint above and below openings extending 24” beyond each side of opening.

B. Lap splices a minimum of 6” and install prefabricated corners and tees at such locations. Do not extend reforcing through expansion joints. Center reinforcing in joint with 5/8” minimum mortar coverage on the exterior face and ½” minimum mortar coverage on the interior face.

C. Do not extend reinforcing through control joints when anchorage is provided on each side of joint. If no anchorage is provided at joint, extend reinforcing through control joint at 48” on center.

D. Reinforce bond beams and lintels as indicated with continuous bars placed as the work progresses. Maintain ½” minimum clear distance between masonry units and reinforcement.

3.06 ANCHORING:

A. Anchor interior partitions to abutting or intersecting walls by common bond or with prefabricated reinforcing tees.

B. Anchor interior load bearing partitions laterally a maximum of 12’-0” o.c. by either an intersecting partition or anchorage to foundation with 4-#4Ø dowels and continuous 4 #4Ø bars to top of wall. Grout fill cells to top of wall.

C. Do not attach construction supports to wall except where specifically permitted by the Architect.

D. Intersecting load bearing masonry walls and partitions shall be bonded by the use of rigid steel anchors at twenty-four (24) inches o.c. maximum. Corners shall have a standard masonry bond by overlapping units and shall be solid grouted.

3.07 CONTROL JOINTS:

A. Locate 3/8” wide control joints as indicated but do not exceed 30 feet on centers. Keep vertical joints straight, true and continuous from top to bottom of masonry.

B. Use sash units to form control joints and install continuous control joint filler with sash units tightly butted to compress neoprene flanges and completely seal joint. Where masonry abuts structural concrete or steel and control joint filler cannot be used, keep joint clean of mortar as work progresses or use expansion joint spacer.

C. Locate building expansion joints as indicated and install expansion joint spacer properly recessed back from face to allow for sealant.

3.08 EMBEDDED ITEMS:

A. Build in flashing, sleeves, anchors, clips, mechanical and electrical items, and accessories as work progresses. Accurately cut units to fit all plumbing, ducts, openings and electrical work with all holes neatly patched.

B. Install loose lintels, as indicated in full beds of mortar. Fill voids at metal frames with mortar and build in frame anchors.

3.09 GROUTING:

A. Fill with grout, vertical cells, bond beams, lintels and other structural members having reinforcement. Secure in place and inspect reinforcing before grouting. Keep mortar droppings out of grout space and puddle or vibrate all grout in place.

B. Provide solid bearing under structural members at least 8” vertically and at least 16” horizontally. Bearing shall be hollow units reinforced with 2#4Ø bars U.N.O. and filled with concrete grout.

C. Build masonry in filled cell construction to preserve the unobstructed vertical continuity of the cells to be filled. Fully bed all walls and cross webs forming such cells to prevent leakage of grout and strike cell joints smooth. Maintain a continuous vertical alignment of cells so the unobstructed cell area is not less than 2”x3”.

D. Grout vertical cells in lifts not to exceed 4’-0”. Stop grout where necessary at mid-point but not over openings, when filling trough unit and provide suitable dam to retain grout. Stop grout one and one half inches below the top of the last course when filling vertical cells to form key for next pour.

E. Grout from inside face of masonry and prevent grout from staining masonry face. Protect projecting surfaces from droppings and clean immediately any grout which comes in contact with face of masonry.

3.010 CLEANING:

A. Keep face of blockwork free from excess mortar while laying blocks. Clean blockwork that will remain exposed, promptly, with fiber brushes and clear water. Use of wire brushes or acid permitted only with specific approval.

B. Repair and repoint defective work and pin line holes to match adjacent similar work. Replace broken or damaged blocks.

END OF SECTION

SECTION 05 41 00 — LIGHT GAGE METAL FRAMING SYSTEMS AND GYPSUM SHEATHING

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Furnish and install exterior metal stud framing as shown on the drawings and specified herein.

B. Furnish and install water resistant gypsum board sheathing at exterior face of exterior metal studs.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Masonry.

B. Interior drywall systems.

C. Wall Insulation.

D. Dampproofing and Waterproofing.

E. Exterior plaster (stucco).

1.4 SUBMITTALS

A. Submit manufacturer’s product data describing all materials.

B. Submit manufacturer’s certification of structural properties, only for products to be used in the project.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

1.6 DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered in manufacturer's original packaging and stored flat in a covered, dry area providing protection from damage and exposure to the elements.

B. Damaged or deteriorated materials shall be removed from the premises.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. STUDS AND FRAMING: Unimast, Clark Dietrich, Maverick Steel Co., Dale Industries, Delta Metals, Bostwick, American Studco Inc.

B. GYPSUM BOARD SHEATHING: United States Gypsum Co., National Gypsum Co., Domtar Gypsum, Inc. Georgia Pacific, Temple Inland.

2.2 MATERIALS

A. STRUCTURAL STUDS AND RUNNERS: Galvanized "Cee" studs in sizes and gauges as indicated in the drawings. Unless otherwise indicated in the drawings, minimum gauge shall be 16 gauge and the following structural properties shall apply:

SIZE	ABOUT MAJOR AXIS X-X			ABOUT MINOR AXIS Y-Y		
	Ix	Sx	rx	Iy	Sy	ry
3-5/8"	.906	.500	1.430	.139	.142	.614
4"	1.145	.572	1.566	.147	.143	.615
6"	3.016	1.005	2.262	.180	.149	.595
8"	6.071	1.518	2.923	.201	.152	.565

B. SHEATHING FASTENERS: Unimast self-drilling screw fasteners (bugle head).

C. SHEATHING: Fire resistant gypsum board with treated water resistant gypsum core surfaced with water repellant paper both faces –1/2" x 4' x 8' with tongue and groove joint design at long edges. Meet requirements of ASTM C-79. Provide 5/8" thick rated X core where specifically indicated on the drawings.

D. All metal studs, track, and bridging shall be formed from ASTM A-446 commercial grade steel having a minimum yield of 33,000 psi for 18 gauge and lighter members and 50,000 psi for 16 gauge and heavier members.

E. All framing components shall be galvanized. Tracks, runners, bridging and bracing shall match grade and gauge of studs.

PART 3 - EXECUTION

3.1 GENERAL

A. Install studs plumb and in plane, without twist. System installation shall be in accordance with AISI Design Manual for “Light Gauge Cold Formed Steel”.

B. All framing components shall be cut tight against abutting members. Members shall be held firmly in position until properly fastened.

C. All attachments of axial loaded framing components shall be welded in accordance with the American Welding Society’s “Recommended Practices for Resistance Welding” and shall transfer the imposed load into the adjoining member. Use no splices in axial loaded members.

D. Attachments of framing components not subject to axial loads may be welded or screw fastened.

E. Members shall be braced as required to resist all wind loads and construction loading for which the system has been designed. System shall be braced as erected and shall not be left overnight without adequate bracing.

F. Framing components used to frame openings shall be of a size and type to transfer any load imposed on the opening into the members adjacent to the opening. Additional framing shall be provided adjacent to the opening to carry the load imposed.

G. Welds in galvanized material shall be coated with “ZRC” cold galvanizing after wire brushing.

3.2 ERECTION

A. TRACK FASTENING: Secure metal floor track to concrete floor slab with Type “A” or “B” fasteners spaced as scheduled in the table below. For determining unbraced wall height, ceiling does not qualify as bracing.
   1. Type “A” fastener – minimum 5/32” diameter x 1-1/4” long powder actuated fasteners. Hilti #DS32P10 or Ramset #2335.
   2. Type “B” fastener – minimum 1/4" diameter x 2” long drilled sleeve anchor. Hilti sleeve anchor or Ramset “Thunder Nail”.
   3. Demonstrate to the Architect that fasteners can be driven full length into concrete slab tight to stud track.
   4. Use similar fasteners (and spacing) suitable for steel at overhead track or weld track to overhead steel at 12” o.c.
   5. At track splices use anchored channel inserts or fully weld.

Spacing Schedule for Type A & B Fasteners

MAX. SPACING OF FASTENERS	***MAX. UNBRACED WALL HEIGHT**	
	TYPE A	TYPE B
24”	7.4 FT.	8.3 FT.
16”	11.1 FT.	12.4 FT.
12”	14.8 FT.	16.5 FT.
8”	24.9 FT.	24.9 FT.
6”	29.7 FT.	33.2 FT.

*NOTE: Ceiling at wall does not reduce unbraced wall height.

B. STUD FASTENING: Each stud shall be fastened to top and bottom track (prior to gypsum board sheathing or interior wall finish) using one of the following two methods:
   1. Screw fastening: One self-drilling screw at the front and back faces of the top and bottom tracks for each stud (4 fasteners per stud.)
   2. Welding: One weld at the front face of the top and bottom tracks for each stud (2 welds per stud).
   3. Additional: The above minimum fasteners are required regardless of any additional bracing or intermediate fastening which may be indicated in the drawings or required.

C. BRIDGING: Provide bridging at all exterior stud walls whether or not indicated in the drawings. Unless more stringent requirements are indicated in the drawings provide the following:
   1. Wind loading resistance only: Provide multiple bridging rows spaced 5'-0" o.c. vertically maximum.
   2. Axial loaded members: For stud lengths less than 10 feet, provide 2 rows of bridging at third points. For stud lengths 10 feet and grater, provide multiple bridging rows spaced 42" o.c. vertically maximum.

D. SHEATHING INSTALLATION: Apply sheathing panels horizontally with the "v" edge turned up. Install with joints and penetrations tight and neatly fit. Stagger end joints over studs with screws spaced at maximum 12" centers at each stud and at 12" o.c. along top and bottom runners.

END OF SECTION

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Work under this section shall include all labor, materials, equipment, and accessories necessary for the fabrication and installation of all miscellaneous metal work as indicated in the drawings and as specified herein.

B. The items listed herein are not necessarily inclusive of all items required to be furnished.

1.3 SECTION REQUIREMENTS

A. Submittals: Shop Drawings showing details of fabrication and installation.

PART 2 - PRODUCTS

2.1 METALS

A. GENERAL: For the fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled or stamped trade names, and rough edges or finish.
   1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
   2. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
   3. Rolled Steel Floor Plate: ASTM A 786/A 786M.
   4. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.
   5. Round steel tubing and pipe are sized differently. Tubing is designated by OD and wall thickness. Pipe is designated by NPS and weight or schedule number.
   6. Steel Pipe: ASTM A 53, standard weight (Schedule 40), black finish.
   7. Shop Primer:
      a. Typical: Red Oxide or Zinc Chromate Primer conforming to Federal Specification TT-P-664C (no lead). Verify compatibility with specified finish paint.

8. Galvanizing: Hot-dip process per ASTM A-123.
9. Bolts: Comply with ASTM A-307 for standard bolts and ASTM A-325 for high strength bolts. Furnish certification that bolts are domestic orgin.
10. Pipe: Conform to ASTM A-53, Schedule 40 for steel pipe and ASTM B-429, Schedule 40 for aluminum pipe.

B. FABRICATED ITEMS: Items listed below represent principal items of miscellaneous metal fabrications required for the project. Contractor shall furnish items listed and all miscellaneous metal items indicated in the drawings or required for a complete installation.
1. Steel Pipe Railings: Schedule 40 x 1-1/2" diameter steel pipe. Provide smooth radiused bends without deformation. Provide end caps at all wall returns. Grind all welds smooth. Provide top rails in continuous lengths. Provide shop primer coat of paint compatible with schedule finish coat. Provide with cast steel wall brackets as manufactured by Julius Blum & Co. or approved equivalent.

2.2 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107; recommended by manufacturer for exterior applications.

2.3 FABRICATION

A. General: Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges. Form bent-metal corners to smallest radius possible without impairing work.

B. Welding: Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. At exposed connections, finish welds and surfaces smooth with contour of welded surface matching those adjacent.

C. Fabricate steel pipe columns with steel base and top plates drilled for anchor and connection bolts and welded to pipe with continuous fillet weld same size as pipe wall thickness.

1. Provide 1/2-inch (12-mm) base plates with four 5/8-inch (16-mm) anchor bolts and 1/4-inch (6-mm) top plates.

2.4 STEEL AND IRON FINISHES

A. Hot-dip galvanized steel fabrications at exterior locations.

B. Prepare uncoated ferrous metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning," and paint with a rust-inhibitive primer complying with performance requirements of FS TT-P-664.

2.5 PAINT AND FINISHES

A. Shop prime all metal fabrications, except aluminum or stainless steel items. Shop prime galvanized items only where scheduled for finish paint. Remove rust, scale, oil, grease and other deleterious materials before application of shop paint. Provide a uniform minimum dry film thickness of 2.0 mils. Provide full coverage of joints, corners, and edges.

B. Separate dissimilar metals to protect against electrolysis. Apply a bituminous coating o approximately 30 dry mils thickness, tape or other suitable permanent separator on concealed contact surfaces of dissimilar metals.

PART 3 - EXECUTION

3.1 GENERAL: Install all items as indicated in the drawings and approved shop drawings. Coordinate installation with all affected trades. Attach members firmly in proper position that is level, plumb, and parallel to adjoining construction (except where slope is indicated).

3.2 EXPANSION JOINT COVERS: Where void is constructed in concrete slab for installation of joint cover assembly, provide reinforcing projecting from vertical walls of void into grout fill to prevent separation between concrete void and grout.

END OF SECTION

SECTION 06 05 00 - DECORATIVE PLASTIC LAMINATE

PART 1 - GENERAL

1.0 COORDINATION

A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.1 SECTION INCLUDES

A. Standard Decorative Laminates.
B. Chemical Resistant Decorative Laminates.
C. Moldings.
D. Adhesives.

1.2 RELATED REQUIREMENTS

A. Division 06: Wood, Plastics, and Composites (Interior Architectural Woodwork, Finish Carpentry, Architectural Wood Casework, Wood Paneling, Adhesives).
B. Division 08: Interior Doors.
C. Division 10: Interior Specialties (Toilet Partitions, Cubicles, Wall Paneling).
D. Division 12: Furnishings (Laminate Clad Casework, Specialty Casework, Residential Casework or Office, Retail, Hospitality, Institutional Furniture).

1.3 REFERENCES

A. Reference Standards: In addition to requirements, comply with applicable provisions of following for design, materials, fabrication and installation of component parts:
   1. NEMA LD3 - National Electrical Manufacturer Association.
   2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   3. ASTM E162 - Surface Flammability and 662 Rate of Smoke Generation.
   4. U.S. Coast Guard – Conforms to IMO FTP Code Part 2 (smoke toxicity) and Part 5 (surface flammability).

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 00.
B. Product Data:
   1. Submit product data, including manufacturer’s technical data sheet for specified products, including literature for high-pressure decorative laminate, adhesive for bonding plastic laminate, and substrate information as related.
C. Shop Drawings:

1. Submit shop drawings showing layout, profiles and product components, including edge conditions, panel joints, accessories, designs and textures.

D. Samples:
1. Submit selection and verification samples for product type, designs and textures.

E. Quality Assurance Submittals:
1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties, if required.
2. Manufacturer's technical data sheets for laminate and adhesives.
3. Manufacturer's Material Safety Data Sheets (MSDS).
4. Certifications:
   a. Recycled Content.
   b. Forest Stewardship Council (FSC).
   c. VOC compliance with local jurisdictions.

F. Submit GREENGUARD Indoor Air Quality or SCS Indoor Advantage Gold Certificates showing compliance with VOC requirements.

G. Maintenance: Submit 2 copies of manufacturer's Care and Maintenance Guide.

1.5 REGULARY REQUIREMENTS

A. Adhesives:
1. SCAQMD (South Coast Air Quality Management District).
2. Ozone Transport Commission (OTC) model Rule for Adhesives and Sealants.

1.6 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer Qualifications: Manufacturer producing product in ISO 9001 certified facility.
2. Fabricator/Installer must be experienced in performing work of similar type and scope.

B. Mock-Ups:
1. Install at project site using acceptable products and manufacturer approved installation methods. Obtain Architect's acceptance of finish color, texture, pattern, fabrication, and installation standards. Comply with Division 01 Quality Control.
2. Mock-Up Size: 24" x 24"
3. Maintenance: Maintain mock-up during construction for fabrication and installation comparison. If required, remove and legally dispose of mock-up when no longer required.
4. Incorporation: If allowed, mock-up may be incorporated into final construction upon Architect's approval.

1.7 DELIVERY, STORAGE & HANDLING

A. Comply with Division 01 Product Requirements Sections.

B. Storage and Protection: Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

B. Adhesive: For best results, do not apply adhesives at temperatures below 65ºF.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Wilsonart LLC
2400 Wilson Place
Temple, Texas 76503-6110
254.207.7000, 800.433.3222, F: 254.207.2384
www.wilsonart.com

B. Substitutions: In Accordance with Section 01 25 00 Substitution Procedures

2.2 STANDARD DECORATIVE LAMINATES

A. Acceptable Product: Wilsonart Laminate.
B. Decorative surface papers, impregnated with melamine resins, bonded under heat and pressure to kraft papers impregnated with phenolic resins.
C. General Purpose Type: Wilsonart Type 107, having the following physical characteristics:
1. Sheet thickness: 0.048 inch nominal (1.22mm).
2. Exceeding performance requirements of NEMA LD 3 current revision, Grade HGS.
3. Surface burning characteristics in accordance with ASTM E 84; unbonded.
4. Patterns and Finishes: Selected from manufacturer's full range of available selections.
D. Vertical Surface Type: Wilsonart Type 335, having the following physical characteristics:
1. Sheet thickness: 0.028 inch nominal (0.71 mm).
2. Exceeding performance requirements of NEMA LD 3 current revision, Grade VGS and VGP.
3. Surface burning characteristics in accordance with ASTM E 84; unbonded.
4. Patterns and Finishes: Selected from manufacturer's full range of available selections.
E. Postforming Type: Wilsonart Type 350, having the following physical characteristics:
1. Sheet thickness: 0.039 inch nominal (1.00 mm).
2. Exceeding performance requirements of NEMA LD 3 current revision, Grade HGP.
3. Surface burning characteristics in accordance with ASTM E 84; unbonded.
4. Patterns and Finishes: Selected from manufacturer's full range of available selections.

2.3 CHEMICAL RESISTANT DECORATIVE LAMINATES

A. Acceptable Products: Wilsonart Chemsurf Chemical-Resistant Laminate.
B. Chemical resistant overlay and decorative alpha cellulose surface papers, impregnated with melamine resins, bonded under heat and pressure to kraft papers impregnated with phenolic resins.
C. Chemical Resistant Decorative Laminate: Wilsonart Type 390.
1. Sheet thickness: 0.034 inch nominal (0.86 mm).
2. Meeting bacterial resistance and susceptibility requirements of ASTM G 22.
3. Patterns and Finishes: Selected from manufacturer's full range of available selections.

2.4 ACCESSORY MATERIALS

A. Contact Adhesive:
1. Non-postforming:
a. Wilsonart 1730/1731 Low VOC Contact Adhesive.
b. Wilsonart 730/731 Contact Adhesive, Low VOC canister.

2. Postforming:
   a. Wilsonart H2O Contact Adhesive, water-based.
   b. Water-resistant, non-staining bond for common high pressure laminate (HPL) applications.

B. Cold Press PVA Adhesives
1. Wilsonart 3100 PVA Adhesive: For bonding decorative laminate to wood products.
2. Wilsonart 3105 PVA Adhesive: High solids, for bonding decorative laminate to wood products.
3. Wilsonart 3116 PVA Adhesive: For bonding decorative laminate to wood products and bonding paper-backed products.

C. Hot Press PVA Adhesives
1. Wilsonart 3131 PVA Adhesive: High solids for bonding decorative laminates to wood products.
2. Wilsonart 3132 PVA Adhesive: High solids for bonding decorative laminates to wood products.

D. Postforming and Pinch Rolling PVA Adhesives
1. Wilsonart 3000/3001 PVA Adhesive: High solids for bonding decorative laminate to wood products and postforming applications.

2.5 ADHESIVE APPLICATION EQUIPMENT

A. Manual Spray:
1. Binks
2. Devilbiss

B. Automatic Spray:
1. Binks
2. Devilbiss

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces for conditions that would adversely affect the performance of the decorative or edge performance.

B. Surfaces to be adhesively bonded should be clean, dry and free of any dust, loose paint, wax, moisture, dirt, grease, oil, rust, or other contaminants.

3.2 PREPARATION

A. Surface preparation: Precondition surfacing materials and surfaces to receive surfacing materials in accordance with manufacturer's printed installation instructions.

B. Allow substrates to acclimate to room temperature for 48 hours before bonding.

3.3 INSTALLATION

A. Install materials in accordance with AWS (Architect Woodwork Standards) and requirements of Section 06 40 00, Architectural Woodwork.

3.4 SPRAY APPLICATIONS

A. Comply with adhesive manufacturers printed installation instructions.

B. Apply adhesive uniformly to both surfaces and cover each surface a minimum of 80%.

C. Apply two coats of adhesive to porous surfaces. 100% coverage is recommended for edges.

D. Apply uniform downward pressure (30-40 psi minimum) across the entire bonded surface.

3.5 BRUSH APPLICATIONS

A. Comply with adhesive manufacturers printed installation instructions.
B. Apply adhesive with a brush or solvent-resistant medium nap roller. Apply adhesive uniformly to both surfaces and cover each surface 100%.
C. Provide two coats of adhesive on porous surfaces. Double coat edges.
D. Apply uniform downward pressure (30-40 psi minimum) across the entire bonded surface.

3.6 HAND APPLICATIONS

A. Comply with adhesive manufacturers printed installation instructions

3.7 CLEANING AND PROTECTION

A. Clean decorative plastic laminate in accordance with manufacturer's care and maintenance instructions.
B. Protect installed product and finish surfaces from damage during construction.

END OF SECTION

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide and install all rough carpentry, formwork, wood framing, blocking, wood furring, hardboard and related fasteners as indicated in the drawings or as required to complete the indicated construction.

B. Install all related hardware and fasteners. Provide and install wood furring and/or trim for acoustical panels.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Cast-in place concrete

B. Painting

C. Finish hardware

1.4 SECTION REQUIREMENTS

A. Submittals manufacturer’s printed literature describing wood preservatives treatment system and certifying that system meets all current requirements for applicable Federal, State and local governing agencies.

B. Submittals manufacturer’s printed literature describing fire retardant treatment system, any structural or usage limitations, and certifying that system meets all current requirements for applicable Federal, State and local governing agencies.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

1.6 DELIVERY AND STORAGE

A. Deliver and store lumber, plywood and hardwood on sills and cover for protection.

1.7 QUALITY ASSURANCE

A. All lumber and plywood shall be grade marked by Southern Pine Inspection Bureau, West Coast Lumber Inspection Bureau, American Plywood Association, or Western Wood Products Association.

B. All lumber and plywood shall be marked with producing manufacturer’s trademark.

C. Certificate of inspection issued by grading association for bundled lumber and plywood may substitute for individual piece marking.

PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

A. Dressed lumber, S4S, 15 percent maximum moisture content for 2-inch (38-mm) thickness or less, marked with grade stamp of inspection agency.

2.2 TREATED MATERIALS

A. Preservative-Treated Materials: AWPA C2 lumber and AWPA C9 plywood, labeled by an inspection agency approved by ALSC's Board of Review. After treatment, kiln-dry lumber and plywood to 19 and 15 percent moisture content, respectively. Treat indicated items and the following:

1. Wood members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Concealed members in contact with masonry or concrete.
3. Wood framing members less than 18 inches (460 mm) above grade.
4. Wood floor plates installed over concrete slabs directly in contact with earth.

B. Fire-Retardant-Treated Materials: AWPA C20 lumber and AWPA C27 plywood, interior Type A treatment, labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Use treated lumber and plywood with bending strength, stiffness, and fastener-holding capacities that are not reduced below values published by manufacturer of chemical formulation under elevated temperature and humidity conditions.

2.3 LUMBER

A. Miscellaneous Lumber: No. 3 or Standard grade of any species for nailers, blocking, and similar members as indicated on drawings.

2.4 MISCELLANEOUS PRODUCTS

A. Fasteners: Size and type indicated. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of Type 304 stainless steel.

1. Power-Driven Fasteners: CABO NER-272.
2. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

B. Metal Framing Anchors: Hot-dip galvanized steel of structural capacity, type, and size indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. COORDINATION: Coordinate work with other trades and provide cutting and patching required to accommodate the work. Verify all dimensions by taking field measurements to ensure proper fit. Accurately cut framing and blocking, and fit true to line and level, avoiding shims and wedges.

B. Fit rough carpentry to other construction; scribe and cope for accurate fit. Correlate location of furring, blocking, and similar supports to allow attachment of other construction.

C. ANCHORING AND FASTENTING: Use largest practicable fasteners for each type of work. Bolt nailers and blocking to steel, masonry or concrete members using bolts of proportionate strength to members attached. Unless otherwise noted in the drawings use ¾” diameter bolts at maximum 4’-0” centers. Use concealed fasteners in finish work, set nails and use flathead countersunk screws.

D. WOOD BLOCKING: Install fire-retardant tread wood blocking between metal studs where wall-supported drinking fountains, casework, railings, and other equipment is attached. Install between studs for toilet partitions systems and toilet accessories where anchored to wall. Use minimum 2 x 4 dimension where not indicated otherwise in the drawings.

END OF SECTION

SECTION 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

PART 1- GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Interior standing and running trim and rails.
2. Wood cabinets (casework).
3. Laminate clad cabinets (plastic-covered casework).
4. Cabinet tops (countertops) and plastic-covered chair rails.
5. Flush wood paneling.
6. Interior door frames (jambs).

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 6 Section ‘Rough Carpentry’ for furring, blocking, and other carpentry work that is not exposed to view.
2. Division 6 Section ‘Finish Carpentry” for carpentry exposed to view that is not specified in this section.
3. Division 6 Section ‘Exterior Architectural Woodwork’ for exterior woodwork.
4. Division 8 Section “Flush Wood Doors” for doors specified by reference to architectural woodwork standards.
5. Division 9 Section “Painting” for final finishing of installed painted finish architectural woodwork.

1.03 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of product and process specified in this section and incorporated into items of architectural woodwork during fabrication, finishing, and installation.

C. Fire-retardant treatment data for material impregnated by pressure process to reduce combustibility. Include certification by treating plant that treated materials comply with requirements.

D. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

E. Samples for initial selection purposes of the following in form of manufacturer's color charts consisting of actual units or sections of units showing full range of colors, textures, and patterns available for each type of material indicated.

1. Plastic laminate (standard and premium selections).

F. Samples for verification purposes of the following:

1. Lumber with or for transparent finish, 50 square inches, for each species and cut, finished on one side and one edge.
2. Veneer leaves representative of and selected from flitches to be used for transparent finished woodwork.
3. Wood veneer faced panel products;, with or for transparent finish, 8-1/2 inches by 11 inches, for each species and cut with one half of exposed surface finished, with separate samples of unfaced panel product used for core.
4. Lumber and panel products with factory-applied opaque finish, 8- 1/2 inches by 11 inches for panels and 50 square inches for lumber, for each finish system and color, with one half of exposed surface finished.
5. Laminate clad panel products, 8-1/2 inches, by 11 inches for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.
6. Corner pieces as follows:
   a. Cabinet front frame joints between stiles and rail as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
   b. Miter joints for standing trim.
7. Exposed cabinet hardware, one unit of each type and finish.

G. Product certificates signed by woodwork manufacturer certifying that products comply with specified requirements.

H. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm experienced in successfully producing architectural woodwork similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.

B. Single-Source Responsibility: Arrange for production by a single firm of architectural woodwork with sequence matched wood veneers.

1. Include the veneering of wood doors in the single-firm production, where veneer matching extends across wood doors.

C. Single-Source Manufacturing and Installation Responsibility: Engage a qualified Manufacturer to assume undivided responsibility for woodwork specified in this section, including fabrication, finishing, and installation.

D. Installer Qualifications: Arrange for installation of architectural woodwork by a firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this project.

E. AWI Quality Standard Comply with applicable requirements of “Architectural Woodwork Quality Standards” published by the Architectural Woodwork Institute (AWI) except as otherwise indicated.

F. Hardware Coordination Distribute copies of approved schedule for cabinet hardware specified in Division 8 Section “Door Hardware” to manufacturer of architectural woodwork; coordinate cabinet shop drawings and fabrication with hardware requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

B. Do not deliver woodwork until painting, wet work, grinding, and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in ‘Project Conditions.’

1.06 PROJECT CONDITIONS

A. Environments1 Conditions: Obtain and comply with Woodwork Manufacturer’s and Installer’s coordinated advice for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained and stabilized so that woodwork is within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.

B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before manufacturing woodwork; show recorded measurements on final shop drawings. Coordinate manufacturing schedule with construction progress to avoid delay of Work.

1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with manufacture of woodwork without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

PART 2- PRODUCTS

2.01 HIGH PRESSURE DECORATIVE LAMINATE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high pressure decorative laminates (standard and premium selections) which may be incorporated in the work include:

1. Formica Corp.
2. Nevamar Corp.
3. WilsonArt

2.02 MATERIALS

A. General: Provide materials that comply with requirements of the AWl woodworking standard for each type of woodwork and quality grade indicated and, where the following products are part of

woodwork, with requirements of the referenced product standards, that apply to product characteristics indicated:

1. Hardboard ANSI/AHA A135.4
2. High Pressure Laminate: NEMA LD 3.
3. Medium Density Fiberboard: ANSI A208.2.
4. Particleboard ANSI A208.1
5. Softwood Plywood PS 1.

B. Formaldehyde Emission Levels: Comply with formaldehyde emission requirements of each voluntary standard referenced below:

1. Particleboard: NPA 8.
2. Medium Density Fiberboard: NPA 9.
3. Hardwood Plywood: HPMA FE.

C. Fire-Retardant Particleboard: Where indicated, provide panels complying with the following requirements that have fire-retardant chemicals bonded to softwood particles at time of panel manufacture to achieve products identical to those tested for flame spread of 20 or less and for smoke developed of 25 or less per ASTM B 84 by UL or other testing and inspecting organization acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organization.

1. For 45-lb-density panels and thicknesses of 3/4 inch and less, comply with ANSI A208.1 for Grade 1-M-1 except that minimums for modulus of elasticity and screw-holding capacity on face and edge shall be 300,000 psi, 250 lb, and 225 lb, respectively.
2. For 44-lb-density panels and thicknesses of 13/16 inch to 1-1/4 inch, comply with ANSI A208.1 for Grade 1-M-1 except that minimums for modulus of rupture, modulus of elasticity, internal bond, linear expansion, and screw-holding capacity on face and edge shall be 1300 psi, 250,000 psi, 60 psi, 0.50 percent, 250 lb, and 175 lb, respectively.
3. Product: Subject to compliance with requirements, provide “Duraflake FR” by Duraflake Div.; Willamette Industries, Inc.

2.03 FABRICATION, GENERAL

A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber in relation to relative humidity conditions existing during time of fabrication and in installation areas.

B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of cabinets and edges of solid wood (lumber) members less than 1 inch in nominal thickness: 1/16 inch.
2. Edges of rails and similar members more than 1 inch in nomina1 thickness: 1/8 inch.

C. Complete fabrication, including assembly, finishing, and hardware application, before shipment to project site to minimum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Factory-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges of cutouts with a water-resistant coating.

2.04 FIRE-RETARDANT-TREATED LUMBER

A. General: Where indicated, pressure impregnate lumber with fire-retardant chemicals of formulation indicated to produce materials with fire performance characteristics specified.

B. Fire-Retardant Chemicals: Use chemical formulations specified that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated lumber from untreated lumber.

1. Organic Resin-Based Formulation: Exterior type per AWPA C20 consisting of organic-resin solution, relatively insoluble in water, thermally set in wood by kiln drying.
2. Low-Hygroscopic Formulation: Interior Type A per AWPA C20.

C. Fire Performance Characteristics: Provide materials identical to those tested for the following fire performance characteristics per ASTM test methods indicated by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify treated lumber with c1assification marking of inspecting and testing organization in the form of separable paper label or, where required by authorities having jurisdiction, of imprint on lumber surfaces that will be concealed from view after installation.

1. Surface Burning Characteristics: Not exceeding values indicated below, tested per ASTM E 84 for 30 minutes with no evidence of significant combustion.

a. Flame Spread: 25.
b. Smoke Developed: 50.

D. Mill lumber after treatment, within limits set for wood removal that does not affect listed fire performance characteristics, using a woodworking plant certified by testing and inspecting organization.

E. Mill lumber before treatment and implement special procedures during treatment and drying processes that are needed to prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

F. Kiln-dry woodwork after treatment to levels required for untreated woodwork. Maintain moisture content required by kiln drying before and after treatment.

G. Discard treated lumber that does not comply with requirements of referenced woodworking standard. Do not use twisted, warped, bowed, discolored, or otherwise damaged or defective lumber.

H. Products: Subject to compliance with requirements, provide one of the following:

1. Low-Hygroscopic Formulation (Type A):

a. “Flameproof LHC”; Osmose Wood Preserving, Inc.
b. “Dricon”; Hickson Corporation.

2.05 STANDING AND RUNNING TRIM AND RAILS FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 300.

B. Backout or groove backs of flat trim members and kerf backs of other wide flat members, except for members with ends exposed in finished work.

C. Assemble casings in plant except where limitations of access to place of installation require field assembly.

D. Grade: Premium.

E. Lumber Species: Birdseye Maple, half round.

2.06 STANDING AND RUNNING TRIM AND RAILS FOR OPAQUE FINISH

A. Quality Standard: Comply with AWI Section 300.

B. Grade: Premium.

C. Backout or groove backs of flat trim members and kerf backs of other wide flat members, except for members with ends exposed in finished work.

D. Assemble casing in plant except where limitations of access to place of installation require field assembly.

E. Lumber Species: Any dosed-grain hardwood listed in referenced woodworking standard.

2.07 WOOD CABINETS (CASEWORK) FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 400 and its Division 400A Wood Cabinets."

B. Grade: Premium.

C. AWI Type of Cabinet Construction: Flush overlay.

D. Wood Species for Exposed Surfaces: Maple, rotary cut veneer.

1. Grain Matching: Run and match grain vertically for drawer fronts, doors, and fixed panels.
2. Matching of Veneer Leaves: Slip match.
3. Veneer Matching Within Panel Face: Balance match.

E. Wood Species for Semiexposed Surfaces: Match species and cut indicated for exposed surfaces.

2.08 LAMINATE CLAD CABINETS (PLASTLC.COVERED CASEWORK)

A. Quality Standard. Comply with AWI Section 400 and its Division 400B 'Laminate Clad Cabinets."

B. Grade: Premium.

C. AWI Type of Cabinet Construction: Flush overlay, unless otherwise indicated.

D. Laminate Cladding High pressure decorative laminate complying with the following requirements:

1. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

a. Provide selections made by Architect from laminate manufacturer's full range of standard and premium colors and finishes in the following categories:

(1) Solid colors.
(2) Patterns.

2. Laminate Grade for Exposed Surfaces: Provide laminate cladding complying with the following requirements for type of surface and grade.

a. Horizontal Surfaces Other Than Tops: GP-50 (0.050-inch nominal thickness).
b. Vertical Surfaces: GP-50 (0.050-inch nominal thickness).
c. Edges: GP-50 (0.050-inch nominal thickness).

3. Semiexposed Surfaces: Provide surface materials indicated below:

a. High pressure laminate, GP-28.

2.09 CABINET HARDWARE AND ACCESSORY MATERIAI.8

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section 'Door Hardware.'

B. Cabinet Hardware and Miscellaneous Item Schedule:

1. Adjustable Shelf Standard.

a. Manufacturer/Model No.: Knape & Vogt/No. 255.
b. Size/Type: 5/8" wide x 3/16" deep, recessed.
c. Finish: Bright zinc plate.
d. Remarks: 1/2" vertical adjustment.

2. Adjustable Shelf Support:

a. Manufacturer/Model No.: Knape & Vogt/No. 256.
b. Finish: Bright zinc plate.
c. Remarks: For use with No. 255 standard.

3. Slotted Shelf Standard:

a. Manufacturer/Model No.: Knape & Vogt/No. 51.
b. Size/Type: 3/4" x 3/8" x length shown, surface mount, heavy duty.
c. Finish: Bright nickel plate.
d. Remarks: 1-5/8" vertical adjustment.

4. Adjustable Shelf Bracket:

a. Manufacturer/Model No.: Knape & Vogt/No. 52.
b. Size/Type: 112" wide x shelf depth.
c. Finish: Bright nickel plate.
d. Remarks: For use with No.51 standard.

5. Drawer Slide: (Typical)

a. Manufacturer/Model No.: Grant/No. 329.
b. Size/Type: Full extension, length to suit drawer.
c. Finish: Zinc plate.
d. Remarks: 100 lb. rating.

6. Drawer Slide: (To 4-1/2" drawer depth)

a. Manufacturer/Model No.: Grant/No. 328.
b. Size/Type: Full extension, length to suit drawer.
c. Finish: Zinc plate.
d. Remarks: 50 lb. rating.

7. Knobs (at Suites Level):

    a. Forms + Surfaces Model No. HC430 Series, sizes as selected by Architect from manufacturers standards.
    b. Finish: Anodized black matte.

8. Wire Pulls:

    a. Manufacturer/Model No.: Stanley/No. 4483112
    b. Size/Type: 3-1/2" center wire pulls.
    c. Finish: US 28D.

9. Concealed Hinges:

    a. Manufacturer/Model No.: Stanley/No. 1510.

10. Continuous Hinges:

    a. Manufacturer/Model No.: Stanley/No. STS311-1/4.
    b. Size/Type: 1-1/2" wide x height of door.
    c. Finish: US 32.
    d. Remarks: Provide matching countersunk screws, 2" o.c., both sides.

11. Door Catch (Magnetic type)

    a. Manufacturer/Model No.: Stanley/No. SP4L
    b. Size/Type: 2" x 1-1/4" case size.
    c. Finish: Aluminum.
    d. Remarks: One per leaf to 48", two per leaf to 84".

12. Cabinet Lock

    a. Manufacturer/Modal No.: National/No. C-8053.
    b. Size/Type: Disc tumbler cam lock.
    c. Finish: US 26D or US 32D.
    d. Remarks: Furnish two keys per lock; keyed to Building Standard.

13. Sliding Glass Door Locks: K&V 965NP, keyed to building system.
14. Track, Upper Guide & Sheaves: Stylmark Model No. 810005 Assembly, 204-Ri clear anodized finish.

C. Hardware Standard Comply with ANSI/BEMA A156.9 "American National Standard for Cabinet Hardware" for items indicated by reference to BIIMA numbers or referenced to this standard.

D. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for BHMA code number indicated.

1. Dark Oxidized Satin Bronze, Oil Rubbed, on Bronze Base: BHMA 613 and matching Architect's sample.
2. Satin Chromium Plated, Brass or Bronze Base: BHMA 626.
3. Satin Chromium Plated, Steel Base: BHMA 652.
4. Satin Stainless Steel, Stainless Steel Base: BHMA 630.

E. For concealed hardware provide manufacturer's standard finish that complies with product class requirements of ANSJ/BHMA A156.9.

F. Clear Tempered Float Glass for Shelves: ASTM C 1048, Condition A, style I, type I, quality q3, class 1, seamed at edges before tempering, 1/4-inch thick unless otherwise indicated.

2.10 ARCHITECTURAL CABINET TOPS (COUNTERTOPS) AND CHAIR RAILS:

A. Quality Standard: Comply with AWI Section 400 and its Division 400C.

B. Type of Top and Chair Rail: High pressure decorative laminate complying with the following:

1. Grade: Custom.
2. Laminate Cladding for Horizontal Surface: High pressure decorative laminate as follows:

a. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

(1) Provide selections made by Architect from manufacturer's full range of standard and premium colors and finishes in the following categories:

(a) Solid colors.
(b) Patterns.

b. Grade: GP-50 (0.050-inch nominal thickness).
c. Edge Treatments:

(1) Plastic Laminate Edge Treatment: Same as laminate cladding on horizontal surfaces.
(2) Wood Edge Treatment: Lumber edge for transparent finish, with matching wood species and cut to be determined.

2.11 FLUSH WOOD PANELING FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 500 and its Division 500A.

B. Grade: Premium.

C. Veneer Species: Birdseye Maple half round.

D. Matching of Adjacent Veneer Leaves: Slip match.

E. Veneer Matching Within Panel Face: Best match.

F. Fire Performance Characteristics: Provide paneling composed of panels of wood veneer density and fire-retardant particleboard that are identical in construction to units tested for the following surface burning characteristics per ASTM E 84 by UL or other testing and inspecting organization acceptable to authorities having jurisdiction. Identify panels with appropriate markings of applicable testing and inspecting organization on surfaces that will be concealed from view after installation.

1. Flame Spread: 75 or less.
2. Smoke Developed: 40 or less.

2.12 INTERIOR DOOR FRAMES FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 900B.

B. Grade: Premium.

C. Lumber Species: Maple, rotary cut veneer.

2.13 CLOSET AND UTILITY SHELVING:

A. Quality Standard: Comply with AWI Section 600.

B. Shelving for Painted Finish (By Section 09 91 00): Comply with the following requirements:

1. Grade: Economy.
2. Shelving Material: Maple faced veneer core plywood.
3. Lumber: Ponderosa Pine or Poplar.

2.14 FASTENERS AND ANCHORS

A. Screws: Select material, type, size, and finish required for each use. Comply with FS FF-S-111 for applicable requirements.

1. For metal framing supports, provide screws as recommended by metal framing manufacturer.

B. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

C. Anchors: Select material, type, size, and finish required by each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts and anchors, as required, to be set into concrete or masonry work for subsequent woodwork anchorage.

2.15 FACTORY FINISHING OF INTERIOR ARCHITECTURAL WOODWORK

A. Quality Standard: Comply with AWI Section 1500 unless otherwise indicated.

B. General: The entire finish of interior architectural woodwork is specified in this section, regardless of whether factory applied or applied after installation.

1. Factory Finishing: To the greatest extent possible, finish architectural woodwork at factory. Defer only final touch-up, cleaning, and polishing until after installation. Painted finish by Section 09 91 00 except prime coat.

C. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces and simi1ar preparations for finishing of architectural woodwork, as applicable to each unit of work.

D. Transparent Finish for Closed-Grain Woods: Comply with requirements indicated below for grade, finish system, staining, effect, and sheen.

1. Grade: Premium.
2. AWI Finish System #5: Catalyzed polyurethane.
3. Staining for Cherry Only: Match approved sample for color.
4. Effect: Open grain (not filled).
5. Sheen: Dull satin 15-20 deg.

E. Opaque Finish: Comply with requirements indicated below for grade, finish system, color, effect, and sheen:

1. Grade: Premium.

2. AWI Finish System #11: Catalyzed polyurethane.
3. Color: Match Architect's sample.
4. Sheen: Medium-gloss rubbed effect 35-45 deg.

2.16 MISCELLANEOUS ACCESSORIES

A. Steel Countertop Support Bracket: provide prefinished steel bracket supports at locations as shown on drawings. Brackets shall be by A&M Hardware (888) 647-0200 info@aandmhardware.com Other equal products may be provided if and as specifically approved by Architect by substitution request during bidding period.

PART 3- EXECUTION

3.01 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.

B. Deliver concrete inserts and similar anchoring devices to be built into substrates well in advance of time substrates are to be built.

C. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.02 INSTALLATION

B. Quality Standard. Install woodwork to comply with AWI Section 1700 for same grade specified in Part 2 of this section for type of woodwork involved.

C. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 118 inch in 8'-0" for plumb and level (including tops) and with no variations in flushness of adjoining surfaces.

D. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

E. Fire-Retardant-Treated Wood. Handle, store, and install fire- retardant-treated wood to comply with recommendations of chemical treatment manufacturer including those for adhesives where are used to install woodwork.

F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where prefinished matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.

G. Standing and Running Trim and Rails: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns and miter at corners.

H. Cabinets: Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated. Maintain veneer sequence matching (if any) of cabinets with transparent finish

I. Tops: Anchor securely to base units and other support systems as indicated.

J. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips and by blind nailing on backup strips, splined-connection strips, and similar associated trim and framing. Do not face nail unless otherwise indicated.

K. Complete the finishing work specified in this section to whatever extent not completed at shop or before installation of woodwork.

L. Refer to the Division 9 sections for finishing of painted architectural woodwork.

3.03 ADJUSTMENT AND CLEANING

A. Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.04 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensures that woodwork is being without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 06 61 16 - SOLID SURFACING

PART 1 – GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 SUMMARY

A. Section Includes:
1. Gibraltar Solid Surface Material.
2. Earthstone Solid Surface Material.
3. Solid Surface Material Shaped Goods (Wilsonart Sinks).

B. Related Sections:
1. Finish Carpentry: Section 06 10 00.
2. Architectural Woodwork: Section 06 40 23.
3. Sealants: Section 07 92 00.
4. Door Thresholds at Ceramic Tile: Section 09 30 13.
5. Plumbing: Division 22.

1.2 SYSTEM DESCRIPTION

A. Gibraltar Solid Surface Sheet: Homogenous sheet material composed of acrylic resins, fire-retardant filler materials, and coloring agents.

B. Earthstone Solid Surface Sheet: Homogenous sheet material composed of acrylic resins, fire-retardant filler materials, and coloring agents.

C. Solid Surface Shaped Goods (Wilsonart Sinks): Cast items of homogenous material composed of polyester and acrylic resins, fire-retardant filler materials, and coloring agents.

1.3 SUBMITTALS

A. Comply with Section 01 33 00, unless otherwise indicated.

B. Product Data:
1. Detailed specification of construction and fabrication.
2. Manufacturer's installation instructions.
3. Manufacturer's detailed recommendations for handling, storage, installation, protection, and maintenance.

C. Shop Drawings: Installation details including location and layout of each type of fabrication and accessory.

D. Samples: Full range of standard colors and patterns.

E. Contract Closeout Submittals: Comply with Contract Documents.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Wilsonart certified solid surface fabricator/installer.

B. Installer Qualifications: Firm experienced in installation or application of systems similar in complexity to those required for this Project, including specific requirements indicated.

1. Acceptable to or licensed by manufacturer.

C. Source Limitations: Obtain materials and products from single source.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver fabrications appropriately wrapped in protective materials.

B. Protect fabrications from damage.

1.6 PROJECT CONDITIONS

A. Maintain relative humidity planned for building occupants and an ambient temperature between 65 and 75_F for 48 hours prior to and during installation. After installation, maintain relative humidity and ambient temperature planned for building occupants.

1.7 WARRANTY

A. Furnish manufacturer's limited 10 year warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Wilsonart International, (800) 433-3222, www.wilsonart.com.
1. Gibraltar Solid Surface, Type 051.
2. Earthstone Solid Surface, Type 051.

B. Substitutions: Permitted, in accordance with Section 01 25 00 Substitution Procedures.

2.2 GIBRALTAR SOLID SURFACE SHEET

A. Nominal sheet thickness: 0.50 inch (13 mm)
B. Surface burning characteristics in accordance with ASTM E 84: Class I or A, and as follows:
1. Flame spread: < 25.
2. Smoke developed: <25.
C. Liquid Absorption, ISO 4586-2, for 1/2 inch material thickness: 0.4 percent after 2 hour period.

D. Izod Impact, ASTM D 256, Method A: 0.3 foot pounds per inch.

E. Tensile Modulus, ASTM D 638 Nominal: 1.2 million pounds per square inch.
F. Thermal Expansion, ASTM D 696: 0.000018 inch per inch per degree F, maximum.
G. Hardness, ASTM D 2583, Barcol Impressor: 57.
H. Flexural Toughness, ASTM D 790: 3 (in.-lb,/in³).
I. Deflection Temperature under load, ASTM D 648: 90 degrees C.
J. Stain Resistance, ANSI Z-124.3 Modified; 3.4: No effect.
K. Boiling Water Resistance, NEMA LD 3-3.05: No effect.
L. High Temperature Resistance, NEMA LD 3-3.06: No effect.
M. Radiant Heat Resistance, NEMA LD 3-3.10: No effect.
N. Light Resistance, NEMA LD 3-3.03: No effect.
O. Ball Impact Resistance, NEMA LD 3-3.08, one half pound ball, unsupported: 125 inches.
P. Specific Gravity (Density ASTM D792): 1.60 grams per cubic centimeter.
Q. Approximate weight: 4.20 pounds per square foot.
R. Weatherability, ASTM D 2565: Pass.
S. Fungus Resistance, ASTM G 21: Pass.
T. Bacterial Resistance, ASTM G 22: Pass.
U. Pittsburgh Protocol Toxicity: 66.9 grams.
V. Patterns and Finishes: Selected from manufacturer's full range of available selections (*standard*) by Architect.

2.3 EARTHSTONE SOLID SURFACE SHEET

A. Nominal sheet thickness: 0.50 inch (13 mm).
B. Surface burning characteristics in accordance with ASTM E 84: Class II or B, and as follows:
   1. Flame spread: < 26.
   2. Smoke developed: < 35.
C. Liquid Absorption, ISO 4586-2, for 1/2 inch material thickness: 0.4 percent after 2 hour period.
D. Izod Impact, ASTM D 256, Method A: 0.3 foot pounds per inch.
E. Tensile Modulus, ASTM D 638 Nominal: 1.1 million pounds per square inch.
F. Thermal Expansion, ASTM D 696: 0.00002 inch per inch per degree F, maximum.
G. Hardness, ASTM D 2583, Barcol Impressor: 57.
H. Flexural Toughness, ASTM D 790: 5 (in.-lb,/in³).
I. Deflection Temperature under load, ASTM D 648: 90 degrees C.
J. Stain Resistance, ANSI Z-124.3 Modified; 3.4: No effect.
K. Boiling Water Resistance, NEMA LD 3-3.05: No effect.
L. High Temperature Resistance, NEMA LD 3-3.06: No effect.
M. Radiant Heat Resistance, NEMA LD 3-3.10: No effect.
N. Light Resistance, NEMA LD 3-3.03: No effect.
O. Ball Impact Resistance, NEMA LD 3-3.08, one half pound ball, unsupported: 125 inches.

P. Specific Gravity (Density ASTM D792): 1.56 grams per cubic centimeter.
Q. Approximate weight: 4.10 pounds per square foot.
R. Fungus Resistance, ASTM G 21: Pass.
S. Bacterial Resistance, ASTM G 22: Pass.
T. Pittsburgh Protocol Toxicity: 65.4 grams.
U. Patterns and Finish: Selected from manufacturer's full range of available selections (*standard)* by Architect.

2.4 ACCESSORY MATERIALS

A. Joint adhesive: Manufacturer’s standard adhesive to create inconspicuous, nonporous joints, with a chemical bond (WA8215).

B. Sealant: Standard mildew resistant, FDA/UL recognized silicone sealant in color matched or clear formulations.

C. Sink/bowl mounting hardware: Manufacturer's approved bowl clips, brass inserts and fasteners for attachment of undermount sinks/bowls.

2.5 FABRICATION

A. Fabrication to be performed by a Wilsonart certified solid surface fabricator/installer.
B. Fabricate components in shop to greatest extent practical to size and shape indicated, in accordance with approved shop drawing and Wilsonart published requirements.
C. Wilsonart Solid Surface Fabrication Manual (SS0319)
D. Form joints between components using manufacture's standard joint adhesive. Joints shall be inconspicuous in appearance and without voids. Attach 4" (100mm) wide Gibraltar/Earthstone reinforcing strip under joints required by Deck Seam Section of the Wilsonart Solid Surface Fabrication Manual (SS0319).
E. Provide holes and cutouts for plumbing and bath accessories as indicated on shop drawings.
F. Rout and finish component edges to a smooth, uniform finish. Rout all cutouts then sand all edges smooth. Repair or reject defective or inaccurate work.
G. Finish: Surfaces shall have a uniform finish.

    1. Matte: Standard finish for high traffic areas, requires the least amount of maintenance.
    2. Satin: Standard finish for darker Gibraltar and Earthstone patterns, requires minimal maintenance.
    3. Semi-gloss: Higher sheen with greater reflectance, suggested for lower traffic areas, requires increased maintenance
    4. Gloss: Maximum sheen and reflectance, recommended for light traffic areas or vertical applications.

H. Thermoforming (optional): Comply with forming data from manufacturer.
    1. Construct matching molds to form components shape.
    2. Form pieces to shape prior to seaming and joining.
    3. Cut pieces larger than finished dimensions, sand edges, remove all nicks and scratches.
    4. Heat entire component uniformly between 280°–325°F during forming.
    5. Prevent blistering, whitening or cracking of Gibraltar/Earthstone during forming.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surfacing. Identify conditions detrimental to proper or timely installation. Do not commence installation until conditions have been corrected.

3.2 PREPARATION

A. Precondition Wilsonart Solid Surfacing in accordance with manufacturer's printed installation instructions.

3.3 INSTALLATION

A. Install components plumb and level, in accordance with approved shop drawings, project installation details and manufacturer's printed instructions.
B. Form joints using manufacturer's approved adhesive, with joints inconspicuous in finished work.
C. Adhere undermount sinks/bowls to countertop using manufacturer's recommended joint adhesive.
D. Adhere topmount sinks/bowls to countertop using manufacturer's recommended adhesive/silicone sealant.
E. Provide backsplashes and endsplashes as indicated on the drawings. Adhere to countertops using

manufacturer's recommended silicone sealant.

F. Remove excessive adhesive and sealants. Components shall be clean on Date of Substantial Completion.
G. Coordinate plumbing installation with Division 22.

3.4 INSTALLATION OF WINDOW STOOLS

A. Install window stools full length of window, set securely into place using only concealed fasteners and manufacturer's approved adhesive.
B. Window stools shall be plumb, true and level.
C. Provide minimum 1/8″ expansion gaps on both sides of window stools, sealed with Manufacturer's approved sealant.
D. Ease edges and sand smooth.

3.5 INSTALLATION OF VANITIES

A. Install plumb, level, true and straight. Shim as necessary using concealed shims.
B. Attach top securely to base unit or support brackets in accordance with manufacturer's printed instructions.
C. Seal between wall and component with manufacturer's recommended silicone sealant.
D. Attach backsplashes and endsplashes to countertops using manufacturer's recommended silicone sealant.

3.6 PROTECTION

A. Protect surfaces from damage until Date of Substantial Completion. Repair or replace damaged components that cannot be repaired to architect's satisfaction.
B. Fabricator/Installer to provide the Wilsonart® Care and Maintenance kit, review maintenance procedures and the Wilsonart warranty with the head of maintenance upon completion of project.

END OF SECTION

SECTION 07 10 00 — DAMPPROOFING AND WATERPROOFING

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide and install below-grade waterproofing.

B. Provide and apply dampproofing on weather side of inside wythe of all exterior masonry cavity walls.

C. Provide and apply dampproofing and joint taping on weather side of gypsum board sheathing.

D. Provide and install membrane waterproofing (flashing) at exterior walls at door and window openings, and as indicated in the drawings and specified herein.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Unit masonry.

B. Gypsum sheathing.

C. Flashing at roof.

D. Plastic membrane under slab-on-grade.

E. Waterstops.

F. Metal thru-wall flashing.

1.4 SUBMITTALS

A. Submit manufacturer’s printed literature describing each material, restrictions, and manufacturer’s recommended procedures. Submit samples of each material.

B. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the Work under this section for a period of one year after the date of Substantial Completion of the Project.

1.6 QUALITY ASSURANCE

A. Waterproofing company shall have a minimum of 3 years experience in the dampproofing and waterproofing of building structures of similar size and scope as this project.

B. Retain at the job site a properly calibrated gauge for use by the Architect to verify applied thickness of materials.

PART 2 - PRODUCTS

2.1 WALL MATERIALS

A. MEMBRANE FLASHING: 40 mil thick polyethylene backed SBS modified bitumen self-adhering black membrane; “Protecto Flash” as manufactured by Protecto Wrap Co. or “Perm-A-Barrier” as manufactured by W.R. Grace and Co. or “Blueskin SA” as manufactured by Henry Company. Membrane shall comply with the following:

1. Tensile Strength: ASTM D412; 1400 psi.
2. Elongation: ASTM D412; 200% min.
3. Water Absorption: ASTM D570; 0.1% max.

B. DAMPPROOFING: Non-asbestos emulsion type coating No. 352 over No. 207 adhesive primer, as manufactured by Gulf States Asphalt or approved equivalent by Henry Company, Karnak, W.R. Meadows, Celotex, or Sonneborn. Comply with ASTM D1227, Type 1.

C. SHEATHING TAPE: 4” wide glass fabric scrim complying with ASTM D1668 or 40 mil thick polyethylene backed SBS modified bitumen self-adhering tape as manufactured by Protecto Wrap Co. or equivalent by W.R. Grace and Co or Henry Company. Verify compatibility of tape with proposed dampproofing.

2.2 BELOW GRADE WATERPROOFING:

A. WALLS: “Hydrocide Liquid Membrane 5000T”, one part cold applied elastometric, modified urethane. Trowel applied, non-sag, as manufactured by Sonneborn or approved equivalent by Toch Bros. or Tremco or Henry Company.

B. SLABS: “Hydrocide Liquid Membrane, HLM 5000” Cold Applied Seamless Elastomeric, Modified Urethane for use between concrete seal slab and concrete slab-on-grade as manufactured by Sonneborn or approved equivalent by Toch Bros. or Tremco or Henry Company.

C. PROTECTION BOARD: Water-resistant, semi-rigid panel composed of a core of asphalt and inorganic mineral filler particles, bottom reinforcing cover of asphalt-saturated felt and top cover of fiber glass mat weather-coated with a bond-breaking film, as manufactured by W.R. Meadows, Inc or Henry Company.

D. WATERSTOPS: Reference concrete section.

PART 3 - EXECUTION

3.1 INSPECTION

A. Contractor shall inspect exterior face of all masonry cavity walls to ensure that all penetrations and joints are completely filled prior to dampproofing operations beginning.

3.2 MEMBRANE FLASHING

A. Prime concrete and masonry surfaces scheduled to receive membrane flashing using flashing manufacturer's recommended primer to ensure good adhesion.

B. WALL FLASHINGS: Shall be installed above all openings occurring in an exterior wall (doors & windows), at base of exterior wall, and at wall interruptions by columns, beams, slabs, spandrels and other locations as indicated in the drawings. Flashing shall extend to within 1" of outside face of wall, shall be continuous and shall extend through cavity and be turned up to the top first course above finish floor on face of inner wythe, and to extend 1" minimum into back up or inner wythe. End laps to be 9" and side laps 6".

C. STEEL STRUCTURE: Cover all steel columns or beams in exterior walls not protected by dampproofed concrete block or sheathing. Cover steel completely with membrane flashing lap 6" on to masonry on each side of columns. Conform and adhere to steel shapes not fireproofed. Cover all protruding angles or miscellaneous steel.

D. FRAMES: Install at exterior window and door frames and other locations as indicated in the drawings.

E. SHEATHING: Wrap all corners of gypsum board sheathing. See drawings for other details.

3.3 SHEATHING TAPE: Use one of the following systems:

A. Imbed and cover glass fabric scrim tape in dampproofing mastic at all joints, cracks and penetrations at gypsum board sheathing.

B. Apply specified self-adhering tape continuously over all joints, cracks and penetrations prior to beginning dampproofing operations.

3.4 DAMPPROOFING

A. Spray or brush apply dampproofing coating to weather side of all gypsum sheathing and primed concrete block back-up at exterior masonry cavity walls in accordance with the following:
   1. Primer: Minimum ½ gallon material per 100 sq. ft. of wall surface.
   2. Coating: Minimum 2/32" (62.5mils) dry film thickness and minimum 5 gallons material per 100 sq. ft.

B. Cover all corners and work thoroughly into all joints, cracks, or crevices. Finished coating shall be monolithic and free of pin holes or cracks. Seal cracks, voids and joints at dissimilar materials with glass fabric embedded in dampproofing coating.

C. Seal around penetrations including all masonry anchors.

D. Dampproofing shall be applied only when temperature is at 50 degrees F. and rising or above, and when no rain is forecast for the 24 hour period following application. No dampproofing shall be covered by masonry prior to observation by the Architect. All dampproofing shall dry for a minimum of 24 hours prior to being covered by finish masonry.

3.5 BELOW GRADE WATERPROOFING

A. LIQUID MEMBRANE:

1. Install liquid membrane systems at earth side of all below grade walls, between sub-slab ("mud-slab") and structural slab, and all outside surfaces of elevator pit. Allow concrete work to cure a minimum of 14 days. All surfaces shall be smooth, dry, sound and free of honeycombs. Concrete shall be free of curing and parting compounds, wax or other foreign materials.
2. Static joints or cracks less than 1/8" wide shall be sealed with "HLM" as manufactured by waterproofing manufacturer. Material shall fill and over-lap the edges of the joint to a width of 4" on both sides and shall have a minimum surface thickness of 55 (+5) mils.
3. Immediately prior to application of membrane, remove all dust and dirt by use of high-pressure air, by brushing with a soft broom or vacuum cleaning.
4. Apply material at a rate of 4 gallons per 100 square feet of surface to produce a membrane of 55 (+5) mil thick. Carefully control application to avoid runs and sags of fresh material.
5. Apply membrane to prestripped areas at cracks, joints, intersections, penetrations, etc., to provide a minimum total thickness of 110 mils over these areas. Mask any membrane edge exposed to view to provide a straight clean edge.
6. Before the membrane attains a final set, verify the applied thickness by use of a mil-thickness gauge. Where readings indicate a thickness less than specified, immediately apply additional membrane to produce required thickness.
7. Following the application of the membrane, place protection boards over the membrane waterproofing at walls receiving backfill. Use membrane material as required to adhere protection boards. Boards shall be firmly in place with joints closely butted and sealed with gusset tape before backfilling is started.
8. Protect membrane during construction. Any punctures or cuts in the membrane shall be patched and sealed in the manner described above for sealing joints in the sheeting.

END OF SECTION

SECTION 07 21 00 - BUILDING INSULATION

PART 1 - GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 SUMMARY

A. This Section includes the following:

1. Polyencapsulated Batt Insulation
2. Chicken Wire
3. Fiberglass roll or batt insulation

B. Related Sections include the following:

1. Section 09 21 16.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: Full-size units for each type of exposed insulation indicated.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.

D. Research/Evaluation Reports: For foam-plastic insulation.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-

response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.
2. Fire-Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

1.4 DELIVERY, STORAGE AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.

B. Polyencapsulated Batt Insulation

1. Johns Manville
2. Owens Corning
3. Certainteed

Encapsulated, Glass-Fiber Blanket Insulation: ASTM C 665, Type II (non-reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).

1. Exterior Walls: R-19

E. Batt or Roll Insulation:

1. Johns Manville
2. Owens Corning

3. Certainteed

General: Insulation shall be fine fiber, flexible, resilient glass fiber blanket. Moisture absorption shall be less than .2% by volume.

1. Interior Stud Walls: 3 5/8" x 16" wide x 96" sound attenuation batts "R" factor 11. Unfaced.
2. Interior Stud Walls: 6" x 16" wide x 96" sound attenuation batts "R" factor 11. Unfaced

AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

B. Chicken Wire: Provide as support for encapsulated batt insulation attached to the metal building wall 'z' girts.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Review and insure chemical compatibility of cavity wall dampproofing membrane and cavity rigid insulation board prior to installation.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

B. Close off openings in cavities receiving poured-in-place insulation to prevent escape of insulation. Provide bronze or stainless steel screens (inside) where openings must be maintained for drainage or ventilation.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturers written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with

placement.

D. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are required to make up total thickness.

3.4 INSTALLATION OF POLYENCAPSULATED BATTS

A. Encapsulated batts at vertical wall surfaces are to be attached with self tapping screws where attached at z girts. Batts at metal stud wall shall form fit to cavity.

3.5 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Set vapor-retarder-faced units with vapor retarder to warm side of construction. Do not obstruct ventilation spaces, except for firestopping.

1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

C. Apply spray foam insulation in strict compliance with insulation manufacturers' written recommendations by manufacturer approved applicator only. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make it even with studs by using method recommended by insulation manufacturer.

END OF SECTION

SECTION 07 26 16 - UNDER-SLAB VAPOR BARRIER

PART 1 – GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 SUMMARY

A. Products supplied under this section:
   1. Vapor barrier and installation accessories for installation under concrete slabs.

B. Related sections:
   1. Section 03 30 00 Cast-in-Place Concrete
   2. Section 07 26 00 Vapor Retarders

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM E1745- 11Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
   2. ASTM E1643- 11Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

B. Technical Reference - American Concrete Institute (ACI):
   1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

1.3 SUBMITTALS

A. Quality control/assurance:
   1. Summary of test results per paragraph 9.3 of ASTM E 1745.
   2. Manufacturer’s samples and literature.
   3. Manufacturer’s installation instructions for placement, seaming and penetration repair instructions.
   4. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Vapor barrier shall have all of the following qualities:
1. Maintain permeance of less than 0.01 Perms [grains/(ft^2 · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
2. Other performance criteria:
   a. Strength: ASTM E1745 Class A.
   b. Thickness: 15 mils minimum

B. Vapor barrier products:
1. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., (877) 464-7834 www.stegoindustries.com.

2. Substitutions will be in accordance with Section 01 25 00.

2.2 ACCESSORIES

A. Seams :
1. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

B. Penetrations of Vapor barrier:
1. Stego Mastic by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
2. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

C. Perimeter/edge seal:
1. Stego Crete Claw by Stego Industries LLC, (887) 464-7834 www.stegoindustries.com.
2. Stego Term Bar by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
3. StegoTack Tape (double sided) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

PART 3 – EXECUTION

3.1 PREPARATION

A. Ensure that subsoil is approved by Architect or Geotechnical Engineer.
1. Level and compact base material.

3.2 INSTALLATION

A. Install vapor barrier in accordance ASTM E1643.
1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
2. Extend vapor barrier over footings and grade beams to a distance acceptable to the structural engineer or stop at impediments such as dowels and waterstops.
3a. Seal vapor barrier to slab perimeter/edge using Stego Crete Claw and remove dirt, debris, and mud from Crete Claw prior to concrete placement.

OR

3b. Seal vapor barrier to footing/grade beam with double sided tape, termination bar, or both.
4. Overlap joints 6 inches and seal with manufacturer’s tape.
5. Apply tape/Crete Claw to a clean and dry vapor barrier.
6. Seal all penetrations (including pipes) per manufacturer’s instructions.

7. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
8. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.

END OF SECTION

SECTION 07 41 13 - INSULATED METAL ROOF PANELS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 SECTION INCLUDES

A. Foamed-insulation-core standing seam metal roof panels, with related metal trim and accessories.

1.3 RELATED REQUIREMENTS

A. Division 05 Section "Structural Steel Framing" for steel framing supporting metal panels.

B. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal panels.

C. Division 07 Section "Metal Wall Panels" for factory-formed metal wall panels.

D. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal copings, flashings, reglets, and roof drainage items in addition to items specified in this Section.

E. Division 07 Section "Joint Sealants" for field-applied Joint Sealants.

F. Division 13 Section "Metal Building Systems" for steel framing supporting metal panels.

1.4 REFERENCES

A. American Society of Civil Engineers (ASCE): www.asce.org/codes-standards:

1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

B. ASTM International (ASTM): www.astm.org:

1. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A 755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
3. ASTM A 792 - Standard Specification for Steel Sheet, 55 % Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
4. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
5. ASTM D 1621 – Compressive Properties of Rigid Cellular Plastics.

6. ASTM D 1622 – Apparent Density of Rigid Cellular Plastics.
7. ASTM C 518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
8. ASTM D 2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
9. ASTM D 4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
10. ASTM D 6226 - Standard Test Method for Open Cell Content of Rigid Cellular Plastics
11. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.
12. ASTM E 84 - Test Methods for Surface Burning Characteristics of Building Materials.
13. ASTM E 1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
14. ASTM E 1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
15. ASTM E 1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.
16. ASTM E 1980 - Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

C. FM Global (FM): www.fmglobal.com:

1. ANSI/FM 4471 Approval Standard for Class 1 Panel Roofs.
2. ANSI/FM 4880 American National Standard for Evaluating Insulated Wall and Roof/Ceiling Assemblies.

D. Underwriters Laboratories, Inc. (UL): www.ul.com:

1. UL 580 - Tests for Uplift Resistance of Roof Assemblies

1.5 QUALITY ASSURANCE

A. Manufacturer/Source: Provide metal roof panel assembly and accessories from a single manufacturer approved under an accredited third-party quality control program.

B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum five years experience in manufacture of similar products in successful use in similar applications.

1.6 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Prior to erection of framing, conduct preinstallation meeting at site attended by Owner, Architect, manufacturer's technical representative, inspection agency and related trade contractors.

1. Coordinate building framing in relation to metal panel system.
2. Coordinate openings and penetrations of metal panel system.
3. Coordinate work of Division 07 Sections "Roof Specialties" and "Roof Accessories" and openings and penetrations and manufacturer's accessories with installation of metal panels.

1.7 ACTION SUBMITTALS

A. Product Data: Manufacturer’s data sheets for specified products.

B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, curbs, vents, snow guards, lightning arresting equipment, and special details. Make distinctions between factory and field assembled work.

1. Include data indicating compliance with performance requirements.
2. Indicate points of supporting structure that must coordinate with metal panel system installation.
3. Include structural data indicating compliance with performance requirements and requirements of local authorities having jurisdiction.

C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.

D. Samples for Verification:

1. Provide 12-inch- (305 mm-) long section of each metal panel profile.
2. Provide color chip verifying color selection.

1.8 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Indicating compliance of products with requirements.

B. Warranty:

1. Submit manufacturer’s written two (2) year limited warranty providing panels to be free from defects in materials and workmanship, beginning from the date of substantial completion excluding coil coatings (paint finishes) that are covered under a separate warranty.
2. The installation contractor shall issue a separate one (1) year warranty against defects in installed materials and workmanship, beginning from the date of substantial completion of the installation.

1.9 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Manufacturer's Warranty: Executed copy of manufacturer's standard warranty.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping. Protect painted surfaces with a protective covering before shipping.

1. Deliver, unload, store, and erect metal panel system and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.
2. Store in accordance with Manufacturer's written instruction. Provide wood collars for stacking and handling in the field.
3. Shield foam insulated metal panels from direct sunlight until installation.

1.11 WARRANTY

A. Special Manufacturer’s Warranty: On manufacturer’s standard form, in which manufacturer agrees to repair or replace metal panel assemblies that fail in materials and workmanship within two years from date of Substantial Completion.

B. The installation contractor shall issue a separate one (1) year warranty against defects in installed materials and workmanship, beginning from the date of substantial completion of the installation.

C. Manufacturer's Weathertight Warranty: On manufacturer’s standard form, in which manufacturer agrees to repair or replace metal panel assemblies that fail to remain weathertight, including leaks, without monetary limitation within 20 years from date of Substantial Completion.

D. Special Panel Finish Warranty: Submit Manufacturer’s twenty-five (25) year limited warranty on the exterior paint finish for adhesion to the metal substrate and twenty-five (25) year limited warranty on the exterior paint finish for chalk and fade.

1. Fluoropolymer Two- Coat System:

   a. Color fading in excess of 5 Hunter units per ASTM D 2244.
   b. Chalking in excess of No. 6 rating per ASTM D 4214.
   c. Failure of adhesion, peeling, checking, or cracking.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design Manufacturer: MBCI Metal Roof and Wall Systems, Division of NCI Group, Inc.; Houston TX. Tel: (877)713-6224; Email: info@ecoficientseries.com; Web: www.mbci.com.

1. Provide basis of design product, or comparable product in accordance with Section 01 25 00 Substitution Procedures.

2.2 PERFORMANCE REQUIREMENTS

A. General: Provide metal roof panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.

B. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, as determined by ASTM E 72 or ASTM E 1592 applied in accordance with IES AC 04, Section 4, Panel Load Test Option or Section 5, Panel Analysis Option:

1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.

   a. Wind Uplift Testing: Certify capacity of metal panels by testing of proposed assembly per ASTM E 72 or ASTM E 1592.

2. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of 1/240 of the span with no evidence of failure. Reference structural drawings for addt. information.

3. Seismic Performance: Comply with ASCE 7, Section 9, "Earthquake Loads."

C. Wind Uplift Resistance: Comply with UL 580 for wind-uplift class UL-90.

D. FM Approvals Listing: Comply with FM Approvals 4471 as part of a panel roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 construction. Identify materials with FM Approvals markings.

1. Fire/Windstorm Classification: Class 1A-120.

2. Hail Resistance Rating: Class 1-SH.

E. Fire Performance Characteristics: Provide metal panel systems with the following fire-test characteristics determined by indicated test standard as applied by UL or other testing and inspection agency acceptable to authorities having jurisdiction.

1. Surface-Burning Characteristics: Provide metal panel systems with the following characteristics when tested per ASTM E 84. The core shall have:

   a. Flame spread index: 25 or less.
   b. Smoke developed index: 450 or less.

2. Fire Performance of Insulated Roof: Class 1 roof panel per ANSI/FM 4880.

F. Air Infiltration, ASTM E 1680:

1. Maximum 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).

G. Water Penetration Static Pressure, ASTM E 1646: No uncontrolled water penetration at a static pressure of 6.24 lbf/sq. ft. (300 Pa).

H. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.

I. Thermal Performance: When tested in accordance with ASTM C 518, "measurement of steady state thermal transmission," the panels shall provide a K-factor of 0.14 btu/sf/hr/deg F at a 75° F (24 C) mean temperature.

2.3 INSULATED METAL ROOF PANELS

A. Mechanically Seamed, Concealed Fastener, Foamed-Insulation-Core Metal Roof Panels: Structural metal roof panel consisting of ribbed exterior metal sheet and interior metal sheet, with factory foamed-in-place polyurethane core in thermally-separated profile, with tongue-and-groove panel edges, mechanically seamed, attached to supports using concealed clips and fasteners.

1. Basis of Design: Nucor Building Group, Metl. Span. CFR IMP. Insulated Metal Roof Panel

2. ASTM A 792/A 792M, structural quality, Grade 50, Coating Class AZ50 (Grade 340, Coating Class AZM150), prepainted by the coil-coating process per ASTM A 755/A 755M.

   a. Exterior Face Sheet: 22 gauge with stucco embossed surface and planked pan profile.

      1) Finish: Fluoropolymer two-coat system.
      2) Color: As selected by Architect from manufacturer's standard colors.

   b. Interior Face Sheet: 24 gauge with stucco embossed surface and planked profile.

      1) Finish: Exposed Galvalume Plus coating.
      2) Color: As selected by Architect from manufacturer's standard colors.

3. Panel Width: 42 inches.

4. Panel Thickness: 4 inch.

5. Insulating Core: Polyurethane with zero ozone depletion potential blowing agent

   a. Closed Cell Content: 95% or more as determined by ASTM D 6226
   b. Compressive Strength: As required to meet structural performance requirements and with a minimum of 15 psi as determined by ASTM D 1621
   c. Minimum Density: 2.0 pcf (32 kg/m3) as determined by ASTM D 1622
   d. Thermal Resistance (R-Value): 8 per inch of panel thickness. Minimum required R-Value of 30 as determined by ASTM C 518 at 75 degrees Fahrenheit mean temperature.

2.4 METAL ROOF PANEL ACCESSORIES

A. General: Provide complete metal roof panel assembly incorporating trim, copings, fasciae, gutters and downspouts, and miscellaneous flashings. Provide required fasteners, closure strips, and sealants as indicated in manufacturer's written instructions.

B. Flashing and Trim: Match material, thickness, and finish of metal panel face sheet.

C. Panel Clips: ASTM C 645, with ASTM A 653/A 653M, G90 (Z180) hot-dip galvanized zinc coating, two-piece, configured for concealment in panel joints, and identical to clips utilized in tests demonstrating compliance with performance requirements.

D. Panel Fasteners: Self-tapping screws and other acceptable fasteners recommended by roof panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal panels by means of factory-applied coating.

E. Joint Sealers: Provide Tape Mastic Sealants, Concealed Joint Sealant, and Urethane Joint Sealants per Section 07 92 00, "Joint Sealants".

F. Steel Sheet Miscellaneous Framing Components: ASTM C 645, with ASTM A 653/A 653M, G60 (Z180) hot-dip galvanized zinc coating.

G. Roof Accessories: Approved by metal roof panel manufacturer. Refer to Section 07 72 00 "Roof Accessories" for requirements for curbs, equipment supports, roof hatches, heat and smoke vents, ventilators, and preformed flashing sleeves.

2.5 FABRICATION

A. General: Provide factory fabricated and finished metal panels and accessories meeting performance requirements, indicated profiles, and structural requirements.

B. Fabricate metal panel joints configured to accept sealant tape providing weathertight seal and preventing metal-to-metal contact and minimizing noise resulting from thermal movement.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings.

2.6 FINISHES

A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

B. Exterior Face Sheet Coil-Coated Finish System

1. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 621, meeting solar reflectance index requirements.

a. Color to be selected by Architect.

C. Interior Face Sheet Coil-Coated Finish System:

1. Polyester Two-Coat System: 0.20 – 0.25 mil primer with 0.7 – 0.8 mil color coat.

a. Color to be selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine metal panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panel installation.

1. Inspect framing that will support insulated metal panels to determine if support components are installed as indicated on approved shop drawings and are within tolerances acceptable to metal panel manufacturer and installer. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of insulated metal panels.

2. Panel Support Tolerances: Confirm that panel supports are within tolerances acceptable to insulated metal panel system manufacturer but not greater than the following:

   a. 1/8 inch (3 mm) in 5 foot (152 cm) in any direction.
   b. 1/4 inch (6 mm) in 20 foot (610 cm) in any direction.
   c. 1/2 inch (9 mm) over any single roof plane.

B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal roof panel system installation.

3.2 METAL PANEL INSTALLATION

A. Mechanically-Seamed, Foamed-Insulation-Core Metal Roof Panels: Install insulated metal panel system in accordance with manufacturer's written instructions, approved shop drawings, and project drawings. Install insulated metal roof panels in orientation, sizes, and locations indicated. Anchor panels and other components securely in place. Provide for thermal and structural movement.

B. Attach panels to metal framing using clips, screws, fasteners, sealants, and adhesives recommended by manufacturer and indicated on approved shop drawings.

1. Fasten metal panels to supports with concealed clips at each location indicated on approved shop drawings, with spacing and fasteners recommended by manufacturer.

2. Provide weatherproof jacks for pipe and conduit penetrating metal panels.

3. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.

C. Attach panel flashing trim pieces to supports using recommended fasteners and joint sealers.

D. Joint Sealers: Install tape sealers and liquid sealants where indicated and where required for weatherproof performance of metal panel assemblies.

1. Seal panels in accordance with insulated panel manufacturer's instructions, and project design drawings.

2. Seal panel joints utilizing tape sealer and vapor seal bead of non-curing butyl; apply continuously without gaps in accordance with manufacturer's written instructions, approved shop drawings, and project drawings.

3. Prepare joints and apply sealants per requirements of Division 07 Section "Joint Sealants."

3.3 ACCESSORY INSTALLATION

A. General: Install metal panel accessories with positive anchorage to building and weather tight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.

2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.

3. Provide concealed fasteners except where noted on approved shop drawings.

4. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage an independent testing and inspecting agency acceptable to Architect to perform field tests and inspections and to prepare test reports.

B. Water-Spray Test: After completing portion of metal roof panel assembly including accessories and trim, test 2-bay area selected by Architect for water penetration, according to AAMA 501.2.

3.5 CLEANING AND PROTECTION

A. Remove temporary protective films immediately in accordance with metal roof panel manufacturer's instructions. Clean finished surfaces as recommended by metal roof panel manufacturer.

B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION

SECTION 07 42 13.13 – FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 SECTION INCLUDES

A. Flush-profile, concealed fastener metal wall panels, with related metal trim, and accessories.

1.3 RELATED REQUIREMENTS

A. Division 05 Section "Structural Steel Framing" for steel framing supporting metal panels.

B. Division 05 Section "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal panels.

C. Division 07 Section "Air Barriers" for air barriers within wall assembly and adjacent to wall assembly.

D. Division 07 Section "Metal Soffit Panels" for soffit panels installed with metal wall panels.

E. Division 07 Section "Sheet Metal Flashing and Trim" for sheet metal flashing items in addition to items specified in this Section.

F. Division 13 Section "Metal Building Systems" for steel framing supporting metal panels.

1.4 REFERENCES

A. ASTM International (ASTM): www.astm.org:

1. ASTM A755 - Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
2. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
3. ASTM C920 - Specification for Elastomeric Joint Sealants.
4. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
5. ASTM D4214 - Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
6. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

7. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
8. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.

1.5 QUALITY ASSURANCE

A. Manufacturer/Source: Provide metal panel assemblies and accessories from a single manufacturer accredited under IAS AC472, Part B.

B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum five years experience in manufacture of similar products in successful use in similar applications.

C. Installer Qualifications: Experienced Installer certified by metal panel manufacturer with minimum of five years experience with successfully completed projects of a similar nature and scope.

1. Installer's Field Supervisor: Experienced mechanic certified by metal panel manufacturer supervising work on site whenever work is underway.

D. Steel Construction Publications: Comply with published recommendations in the following, unless more stringent requirements are indicated.

1. American Institute of Steel Construction (AISC): "Steel Construction Manual."
2. American Iron and Steel Institute (AISI): "Cold Formed Steel Design Manual."

1.6 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Prior to erection of framing, conduct preinstallation meeting at site attended by Owner, Architect, metal panel installer, metal panel manufacturer's technical representative, inspection agency and related trade contractors.

1. Coordinate building framing in relation to metal panel system.
2. Coordinate openings and penetrations of metal panel system.
3. Coordinate work of Division 07 Sections "Roof Specialties" and "Roof Accessories" and openings and penetrations and manufacturer's accessories with installation of metal panels.

1.7 ACTION SUBMITTALS

A. Product Data: Manufacturer’s data sheets for specified products. Include data indicating compliance with performance requirements.

B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, and special details. Make distinctions between factory and field assembled work.

1. Indicate points of supporting structure that must coordinate with metal panel system installation.
2. Include structural data indicating compliance with performance requirements and requirements of local authorities having jurisdiction.

C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.

D. Samples for Verification: Provide 12-inch- (305 mm-) long section of each metal panel profile. Provide color chip verifying color selection.

1.8 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Indicating compliance of products with requirements.

B. Qualification Information: For Installer firm and Installer's field supervisor.

C. IAS Accreditation Certificate: Indicating that manufacturer is accredited under provisions of IAS AC472 Part B.

D. Manufacturer's warranty: Unexecuted sample copy of manufacturer's warranty.

1.9 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Manufacturer's Warranty: Executed copy of manufacturer's warranty.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of components or other damage. Protect panels and trim bundles during shipping.

1. Deliver, unload, store, and erect metal panels and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.
2. Store in accordance with Manufacturer's written instruction. Provide wood collars for stacking and handling in the field.
3. Shield foam insulated metal panels from direct sunlight until installation.

1.11 WARRANTY

A. Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal panel assemblies that fail in materials and workmanship within two (2) years from date of Substantial Completion.

B. Panel Finish Warranty: On Manufacturer's standard form, in which Manufacturer agrees to repair or replace metal panels that evidence deterioration of factory-applied finish within the warranty period, as follows:

1. Fluoropolymer Two-Coat System:

a. Basis of Design System: MBCI, Signature 300.
b. Color fading in excess of 5 Hunter units per ASTM D2244.
c. Chalking in excess of No. 8 rating per ASTM D4214.
d. Failure of adhesion, peeling, checking, or cracking.
e. Warranty Period: 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design Manufacturer: MBCI Metal Roof and Wall Systems, Division of NCI Group, Inc.; Houston TX. Tel: (877)713-6224; Email: info@mbci.com; Web: www.mbci.com.

1. Provide basis of design product.

2. Substitutions in accordance with Section 01 25 00.

2.2 PERFORMANCE REQUIREMENTS

A. General: Provide metal panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.

B. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated, as determined by ASTM E1592:

1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings.

a. Wind Negative Pressure: Certify capacity of metal panels by actual testing of proposed assembly.

2. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of 1/120 of the span with no evidence of failure.

C. Wall Panel Air Infiltration, ASTM E283:

1. No air infiltration at static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).

D. Wall Panel Water Penetration Static Pressure, ASTM E331: No uncontrolled water penetration at a static pressure of 6.24 lbf/sq. ft. (300 Pa).

E. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.

2.3 FORMED METAL WALL PANELS

A. Flush-Profile, Concealed Fastener Metal Wall Panels: Structural metal panels consisting of formed metal sheet with vertical panel edges and two intermediate stiffening beads, symmetrically placed, with flush joints between panels, field assembled with nested lapped edges, and attached to supports using concealed fasteners.

1. Basis of Design: MBCI, FW-120 Panel.
2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, structural quality, Grade 50, Coating Class AZ50 (Grade 340, Coating Class AZM150), prepainted by the coil-coating process per ASTM A755/A755M.

a. Nominal Thickness: 24 gage coated thickness, with stucco embossed surface.

1) Exterior Finish: Fluoropolymer two-coat system.
2) Color: As selected by Architect from manufacturer's standard colors.

3. Panel Width: 12 inches (305 mm).
4. Panel Thickness: 1-1/2 inch (38 mm).

2.4 MISCELLANEOUS MATERIALS

A. General: Provide complete metal panel assemblies incorporating trim, copings, fasciae, gutters and downspouts, and miscellaneous flashings. Provide required fasteners, closure strips, and sealants as indicated in manufacturer's written instructions.

B. Flashing and Trim: Match material, thickness, and finish of metal panels.

C. Panel Fasteners: Self-tapping screws and other acceptable fasteners recommended by metal panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal panels by means of factory-applied coating, with weathertight resilient washers.

D. Panel Sealants:

1. VOC Content of Interior Sealants: Sealants used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Architectural Sealants: 250 g/L.

2. Factory-Applied Seam Sealant: Manufacturer's standard hot-melt type.
3. Concealed Joint Sealants: Non-curing butyl, AAMA 809.2.
4. Elastomeric Joint Sealants: Urethane sealant, single-component, ASTM C920 Type S, Grade NS, Class 25, Use NT, A, M, G, O.
5. Foam Tape: Manufacturer's standard self-adhering type.

2.5 FABRICATION

A. General: Provide factory fabricated and finished metal panels, trim, and accessories meeting performance requirements, indicated profiles, and structural requirements.

B. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings.

2.6 FINISHES

A. Finishes, General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

B. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil primer with 0.7 - 0.8 mil 70 percent PVDF fluoropolymer color coat, AAMA 621, meeting solar reflectance index requirements.

1. Basis of Design: MBCI, Signature 300.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine metal panel system substrate with Installer present. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panels.

1. Inspect framing that will support insulated metal panels to determine if support components are installed as indicated on approved shop drawings and are within tolerances acceptable to metal

panel manufacturer and installer. Confirm presence of acceptable framing members at recommended spacing to match installation requirements of metal panels.

B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with insulated metal panel installation.

3.2 METAL PANEL INSTALLATION

A. Concealed-Fastener Formed Metal Panels: Install metal panel system in accordance with manufacturer's written instructions, approved shop drawings, project drawings, and referenced publications. Install metal panels in orientation, sizes, and locations indicated. Anchor panels and other components securely in place. Provide for thermal and structural movement.

B. Fasten metal panels to supports with fasteners at each location indicated on approved shop drawings, at spacing and with fasteners recommended by manufacturer. Fasten panel to support structure through leading flange. Snap-fit back flange of subsequent panel into secured flange of previous panel. Where indicated, fasten panels together through flush-fitted panel sides.

1. Cut panels in field where required using manufacturer's recommended methods.
2. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by metal panel manufacturer.

C. Attach panel flashing trim pieces to supports using recommended fasteners and joint sealers.

D. Joint Sealers: Install liquid sealants where indicated and where required for weatherproof performance of metal panel assemblies.

1. Seal panel base assembly, openings, panel head joints, and perimeter joints using joint sealers indicated in manufacturer's instructions.
2. Seal perimeter joints between window and door openings and adjacent panels using elastomeric joint sealer.
3. Prepare joints and apply sealants per requirements of Division 07 Section "Joint Sealants."

3.3 ACCESSORY INSTALLATION

A. General: Install metal panel accessories with positive anchorage to building and weather tight mounting; provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel assembly, including trim, copings, flashings, sealants, closure strips, and similar items.
2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
3. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

3.4 CLEANING AND PROTECTION

A. Clean finished surfaces as recommended by metal panel manufacturer.

B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION

SECTION 07 62 00 - PREFORMED METAL COPING

PART 1 – GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 WORK SPECIFIED HEREIN

A. All labor, material, equipment, and services necessary to furnish and install metal coping as shown or specified.

1.2 SPECIFIED PRODUCTS AND SUBSTITUTIONS

A. In accordance with Section 01 25 00.

1.3 SUBMITTALS

A. Submittals required in accordance with Section 01 33 00.

B. Submit detailed Product Data including complete installation details.

C. Submit Shop Drawings

D. Submit 12 inch by 12 inch Samples of sheet metal material. Sample shall indicate finish, color and thickness.

E. Submit complete color chart for Architect's color selection.

1.4 QUALITY ASSURANCE

A. Applicable standards:

1. SMACNA: “Architectural Sheet Metal Manual”, Sheet Metal and Air Conditioning Contractors National Association, Inc.

2. AISC: “Steel Construction Manual”, American Institute of Steel Construction.

3. AISI: “Cold Form Steel Design Manual”, American Iron and Steel Institute.

B. Manufacturer's qualifications:

1. Manufacturer has a minimum of three years experience in manufacturing panels of this nature.

C. Installer's qualifications:

1. Installer of the system shall be an approved installer and certified by the manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Preformed metal coping:

1. Products –Shur-Lok Coping System, as manufactured by AARA Architectural Metals.

B. Gauge:

1. 24 gauge: Zincalume®, Galvalume®, or galvanized steel sheet

C. Splice plates shall be galvanized steel and shall match color and finish of coping. Splice plates shall be 12" long, spaced 10'-0" o.c..

1. Anchor plates shall be 22 gauge galvanized steel mechanically secured to the top of the parapet wall every 5'-0" o.c..

2. Provide mitered corners, expansion joints, and any special accessory pieces for complete installation.

D. Finish:

1. Fluoropolymer coating produced with Kynar 500 or Hylar 5000 resin (20 year warranty).

E. Color:

1. Selected from standard colors.

F. Acceptable manufacturer:

1. AARA Architectural Metals, 4328 E. Magnolia, Phoenix, AZ 85034, (602) 437-9323

G. Other manufacturers desiring approval shall comply with Section 01 25 00.

H. Fasteners:

1. All self-locking rivets and other suitable fasteners shall be supplied by coping manufacturer.

2.2 ACCESSORIES

A. Provide all components required per the metal coping system manufacturer's approved shop drawings for a complete system.

1. All joint sealant is to be a one-part elastomeric polyurethane sealant approved by the metal roof system manufacturer.

PART 3 – EXECUTION

3.0 INSTALLATION

A. Inspect installed work of other trades and verify that such work is complete to a point where this work may continue.

B. Verify that installation may be made in accordance with approved shop drawings and manufacturer's instructions.

C. Installation

1. Accurately lay out the anchor plates 5'-0" o.c. or as recommended by manufacturer

2. Attach splice plates to anchor plates as recommended by manufacturer. Apply butyl sealant tape to the top of the splice plate.

3. Fully engage hemmed 45° kick on front face of coping to kicked front leg of anchor plates. Pivot coping into position over each anchor plate. Hand crimp back of coping over ½" anchor plate kick to secure coping.

4. Leave ¼" joint between abutting ends at splice plates allowing for thermal expansion.

5. Finished installation shall be straight and true.

3.1 CLEANING, PROTECTION

A. Dispose of excess materials and remove debris from site.

B. Clean work in accordance with manufacturer's recommendations.

C. Protect work against damage until final acceptance. Replace or repair to the satisfaction of the Architect and Owner, any work that becomes damaged prior to final acceptance.

D. Touch up minor scratches and abrasions.

3.2 PROJECT CLOSE-OUT

A. Issue a written guarantee to the Owner to maintain the roof and flashing in a watertight condition for a period of two years from the date of substantial completion.

B. Issue a written 20-year guarantee from the manufacturer for the panel finish system.

END OF SECTION

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 SECTION REQUIREMENTS

A. Submittals: Product Data and color Samples.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS

A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under service and application conditions.

B. Elastomeric Sealants: Comply with ASTM C 920.
   1. Single-component, neutral-curing silicone sealant, Type S; Grade NS; Class 25; Uses T, M, and O, with the additional capability to withstand [50 percent movement in both extension and compression for a total of 100 percent movement] [100 percent movement in extension and 50 percent movement in compression for a total of 150 percent movement]. Use for building expansion joints.
   2. Single-component, nonsag polysulfide sealant, Type S; Grade NS; Class 12-1/2; Uses NT, M, G, A, and O. For general exterior use.
   3. Single-component, neutral-curing silicone sealant, Type S; Grade NS; Class 25; Uses T, NT, M, G, A, and O. For general exterior use.
   4. Single-component, nonsag urethane sealant, Type S; Grade NS; Class 25; and Uses NT, M, A, and O. For general exterior use.
   5. Single-component, nonsag urethane sealant, Type S; Grade NS; Class 25; Uses T, NT, M, G, A, and O. Use for exterior traffic-bearing joints, where slope precludes use of pourable sealant.
   6. Single-component, pourable urethane sealant, Type S; Grade P; Class 25; Uses T, M, G, A, and O. Use for exterior traffic-bearing joints.
   7. Single-component, mildew-resistant silicone sealant, Type S; Grade NS; Class 25; Uses NT, G, A, and O; formulated with fungicide. Use for interior sealant joints in ceramic tile, stone, and other hard surfaces in kitchens and toilet rooms and around plumbing fixtures.

C. Latex Sealant: Single-component, nonsag, mildew-resistant, paintable, acrylic-emulsion sealant complying with ASTM C 834. For interior use only at perimeters of door and window frames.

D. Acoustical Sealant for Exposed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834. For interior use only at acoustical assemblies.

E. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound. For interior use only at acoustical assemblies.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with ASTM C 1193.

B. Comply with ASTM C 919 for use of joint sealants in acoustical applications.

END OF SECTION

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors.
4. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Section “Flush Wood Doors”.
3. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
4. Division 08 Section "Door Hardware".
5. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.
7. Details of moldings, removable stops, and glazing.
8. Details of conduit and preparations for power, signal, and control systems.

D. Samples for Verification:

1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40” above sill) or UL 10C.

1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
3. Smoke Control Door Assemblies: Comply with NFPA 105.

a. Smoke "S" Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:

1. CECO Door Products (C).
2. Curries Company (CU).
3. Steelcraft (S).

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
3. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
4. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
5. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Manufacturers Basis of Design:

1. Curries Company (CU) - Energy Efficient - 797 Mercury Series.

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames. Tested for thermal performance in accordance with NFRC 102, and resistance to air infiltration in accordance with NFRC 400. Where indicated provide thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate with 1/16” positive thermal break and integral vinyl weatherstripping.

C. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
3. Manufacturers Basis of Design:

    a. CECO Door Products (C) – SQ SU SR Series.
    b. Curries Company (CU) – M Series.

D. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
3. Manufacturers Basis of Design:

    a. CECO Door Products (C) - SQ SU Series.
    b. Curries Company (CU) - M Series.

E. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

F. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LOUVERS

A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated.

1. Blade Type: Vision proof inverted V or inverted Y.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.

1. Manufacturers: Subject to compliance with requirements, provide door manufacturers standard louver to meet rating indicated.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.7 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator’s shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.8 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.9 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

    a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

    b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
        5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.10 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 SUMMARY

A. Section Includes:

1. Solid core doors with wood veneer faces.
2. Factory finishing wood doors.
3. Factory fitting wood doors to frames and factory machining for hardware.
4. Louvers installed in flush wood doors.
5. Light frames and glazing installed in wood doors.

B. Related Sections:
1. Division 08 Section “Door Schedule”.
2. Division 08 Section "Hollow Metal Doors and Frames".
3. Division 08 Section "Glazing".
4. Division 08 Section "Door Hardware".

C. Standards and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ANSI A208.1 – Wood Particleboard.
3. Intertek Testing Service (ITS Warnock Hersey) - Certification Listings for Fire Doors.
4. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
5. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
6. UL 10C - Positive Pressure Fire Tests of Door Assemblies; UL 1784 - Standard for Air Leakage Tests of Door Assemblies.
7. Window and Door Manufacturers Association - WDMA I.S.1-A Architectural Wood Flush Doors.

1.4 SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, trim for openings, and WDMA I.S.1-A classifications. Include factory finishing specifications.

B. Shop Drawings shall include:

1. Indicate location, size, and hand of each door.
2. Indicate dimensions and locations of mortises and holes for hardware.
3. Indicate dimensions and locations of cutouts.
4. Indicate requirements for veneer matching.
5. Indicate location and extent of hardware blocking.
6. Indicate construction details not covered in Product Data.
7. Indicate doors to be factory finished and finish requirements.
8. Indicate fire protection ratings for fire rated doors.

C. Samples for Initial Selection: For factory finished doors.

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

2. Corner sections of doors, 8 by 10 inches, with door faces and edges representing actual materials to be used.

a. Provide samples for each species of veneer and core material.
b. Finish veneer faced door samples with same materials proposed for factory finished doors.

3. Frames for light openings, 6 inches long, for each material, type, and finish required.

D. Warranty: Provide sample of manufacturer’s warranty.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, latest edition, "Industry Standard for Architectural Wood Flush Doors’.

C. Fire Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40” above sill) or UL10C.

1. Oversize Fire Rated Door Assemblies: For units exceeding sizes of tested assemblies provide manufacturer’s construction label, indicating compliance to independent 3rd party certification agency’s procedure, except for size.

2. Temperature Rise Limit: Where required and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire test exposure.

3. Smoke Control Door Assemblies: Comply with NFPA 105.

1) Smoke "S" Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for receiving, handling, and installing flush wood doors.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package pre-finished doors individually in plastic bags and wrap bundles of doors in plastic sheeting.

C. Mark each door on top rail with opening number used on Shop Drawings.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.8 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
b. Telegraphing of core construction in wood face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

3. Warranty Period for Solid Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 DOOR CONSTRUCTION – GENERAL

A. WDMA I.S.1-A Performance Grade: Extra Heavy Duty; Aesthetic Grade: Premium.

2.2 CORE CONSTRUCTION

A. Particleboard Core Doors:

1. Particleboard: Wood fiber based materials complying with ANSI A208.1 Particleboard standard. Grade LD-2.

2. Adhesive: Fully bonded construction using Polyurethane (PUR) glue.

3. Blocking: As indicated under article “Blocking”.

2.3 BLOCKING

A. Non-Fire-Rated Doors:

1. Provide blocking as indicated below:

a. HB3: 5 inch top and bottom rail blocking, in doors indicated to have closers and kick plates.

B. Fire Rated Doors:

1. Provide blocking as indicated below:

a. HB1: 5 inch in doors indicated to have closers and overhead stops.

2.4 VENEERED DOORS FOR TRANSPARENT FINISH

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ASSA ABLOY Wood Doors (GR): GPD Series.
2. Eggers Industries (EG): Premium Series.
3. Marshfield-Algoma (MF): Signature Series.
4. VT Industries (VT): Artistry Series.

B. Interior Solid Core Doors:

1. Grade: Premium.

2. Faces: Veneer grades as noted below; veneer minimum 1/50-inch (0.5mm) thickness at moisture content of 12% or less.

a. Plain Sliced Select White Maple, A grade faces.

3. Match between Veneer Leaves: Book match.

4. Assembly of Veneer Leaves on Door Faces:

a. Running Match.

5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.

6. Transom Match: Continuous match.

7. Vertical Edges: Matching same species as faces. Wood or composite material, one piece, laminated, or veneered. Minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors.

8. Horizontal Edges: Solid wood or structural composite material meeting the minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors

9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit sanded before applying face veneers.

10. At doors over 40% of the face cut-out for lights and or louvers, furnish engineered composite lumber core.

2.5 LOUVERS

A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated.

1. Blade Type: Vision proof inverted V or inverted Y.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish.

2.6 LIGHT FRAMES AND GLAZING

A. Metal Frames for Light Openings in wood doors and up to and including 20-minute Rating: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated.

1. Manufacturers:

a. Air Louver (LV).
b. All Metal Stamping (AP).
c. Anemostat (AN).
d. Pemko (PE).

B. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with the flush wood door manufacturer's written instructions.

2.7 FABRICATION

A. Factory fit doors to suit frame opening sizes indicated.
1. Comply with requirements in NFPA 80 for fire rated doors.
2. Undercut: As required per manufacturer’s templates and sill condition.

B. Factory machine doors for hardware that is not surface applied. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed steel edges for hardware for pairs of fire rated doors.

C. Openings: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Comply with applicable requirements in Division 08 Section "Glazing."
3. Louvers: Factory install louvers in prepared openings.

D. Electrical Raceways: Provide flush wood doors receiving electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through wire transfer hardware or wiring harness specified in hardware sets in Division 08 "Door Hardware". Wire nut connections are not acceptable.

2.8 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Transparent Finish: Provide a clear protective coating over the wood veneer allowing the natural color and grain of the selected wood species to provide the appearance specified. Stain is applied to the wood surface underneath the transparent finish to add color and design flexibility.

1. Finish: Meet or exceed WDMA I.S. 1A TR8 UV Cured Acrylated Polyester finish performance requirements.
2. Staining:

a. Custom stain to match architect’s sample.

3. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Installation Instructions: Install doors and frames to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install fire rated doors in corresponding fire rated frames according to NFPA 80.

C. Factory Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

E. Field modifications to doors shall not be permitted, except those specifically allowed by manufacturer or fire rating requirements.

3.3 ADJUSTING

A. Operation: Re-hang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 08 33 23 - OVERHEAD COILING SERVICE DOORS

PART 1 GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

E.

1.1 SECTION INCLUDES

A. Overhead coiling insulated doors.

B.

C. Overhead coiling doors.

1.2 RELATED SECTIONS

A. Section 05 50 00 - Metal Fabrications: Support framing and framed opening.

B. Section 06 10 00 - Finish Carpentry: Wood jamb and head trim.

C. Section 08 71 00 - Door Hardware: Product Requirements for cylinder core and keys.

D. Section 09 91 00 - Painting: Field applied finish.

E. Section 26 05 33 - Raceway and Boxes: Conduit from electric circuit to door operator and from door operator to control station.

F. Section 26 05 83 - Wiring Connections: Power to disconnect.

1.3 REFERENCES

A. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM A 666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

C. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

D. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

F. NEMA MG 1 - Motors and Generators.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Overhead coiling insulated doors:
1. Wind Loads: Design door assembly to withstand wind/suction load of 20 psf (958 Pa) without damage to door or assembly components.
2. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles.

B. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Details of construction and fabrication.
4. Installation instructions.

C. Shop Drawings: Include detailed plans, elevations, details of framing members, anchoring methods, required clearances, hardware, and accessories. Include relationship with adjacent construction.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) long, representing actual product, color, and patterns.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

G. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.

B. Installer Qualifications: Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

C. Store materials in a dry, warm, ventilated weathertight location.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 COORDINATION

A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: Overhead Door Corp., 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100.
B. Fax: (972) 906-1499. Web Site: www.overheaddoor.com. E-mail: info@overheaddoor.com.
C.
D. Substitutions: permitted.

E. Requests for substitutions will be considered in accordance with provisions of Section 01 25 00.

2.2 INSULATED OVERHEAD COILING SERVICE DOORS

A. Overhead Coiling Stormtite Insulated Service Doors: Overhead Door Corporation 625 Series.
1. Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.
a. Flat profile type F-265i for doors up to 40 feet (12.19 m) wide.
b. Front slat fabricated of:
1) 22 gauge galvanized steel.
c. Back slat fabricated of:
1) 24 gauge galvanized steel.
d. Slat cavity filled with CFC-free foamed-in-place, polyurethane insulation.
1) R-Value: 7.7, U-Value: 0.13.
2) Sound Rating: STC-21.
3)
2. Finish:
a. Galvanized Steel: Slats and hood galvanized in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester top coat.
1) Powder coat: PowderGuard
(a) PowderGuard Weathered Finish: Industrial textured powder coat provides a thicker, more scratch resistant coat. Applied to entire door system including slats, guides, bottom bar and head plate.
(b)
3. Weatherseals:
a. Vinyl bottom seal, exterior guide and internal hood seals.

b.

4. Bottom Bar:
   a. Two galvanized steel angles minimum thickness 1/8 inch (3 mm) bolted back to back to reinforce curtain in the guides.
   b.
5. Guides: Three Structural steel angles
   a. Finish: PowderGuard Weathered finish with iron/black powder.
   b.
6. Brackets:
   a. Galvanized steel to support counterbalance, curtain and hood.
   b.
7. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inch per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
8.
9. Hood: Provide with internal hood baffle weatherseal.
   a. 24 gauge galvanized steel with intermediate supports as required.
   b.
10. Manual Operation:
    a. Chain hoist.
    b.
11. Windload Design:
    a. Standard windload shall be 20 PSF.
    b.
12. Locking:
    a. Chain keeper locks for chain hoist operation.
    b.
13. Wall Mounting Condition:
    a. Reference drawings.
    b.
14. Operation: Chain operated doors shall open and close with a maximum of 30 pounds of effort utilizing an endless chain and cast iron reduction gears.

2.3 OVERHEAD COILING SERVICE DOORS

A. Industrial Doors: Overhead Door Corporation, 610 Series Service Doors.
   1. Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.
   2.
      a. Curved profile type C-187 for doors up to 15 feet 4 inches (4.67 m) wide, fabricated of:
         1) 22 gauge galvanized steel.
         2)
      b. Curved profile type C-275 for doors up to and between 15 feet 4 inches (4.67 m) and 18 feet 4 inches (5.59 m) wide, fabricated of:
         1) 22 gauge galvanized steel.
         2)
   3. Finish:
      a. Galvanized Steel: Slats and hood galvanized in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester top coat.
         1) Powder coat: PowderGuard
            (a) PowderGuard Weathered Finish: Industrial textured powder coat provides a thicker, more scratch resistant coat. Applied to entire door system including slats, guides, bottom bar and head plate.
            (b)
   4. Weatherseals:

a. Vinyl bottom seal.
b.

5. Bottom Bar:
   a. Two galvanized steel angles.
   b.
6. Guides: Roll-formed galvanized steel shapes attached to continuous galvanized steel wall angle.
   a. Finish: PowderGuard Weathered finish with iron/black powder.
   b.
7. Brackets:
   a. Galvanized steel to support counterbalance, curtain and hood.
   b.
8. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inch per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
9.
10. Hood:
    a. 24 gauge galvanized steel with intermediate supports as required.
    b.
11. Manual Operation:
    a. Chain hoist for doors up to 96 SF.
    b.
12. Windload Design:
    a. Standard windload shall be 20 PSF.
    b.
13. Locking:
    a. Two interior bottom bar slide bolts for manually operated doors.
    b.
14. Wall Mounting Condition:
    a. Reference drawings.
    b.
15. Operation: Chain operated doors shall open and close with a maximum of 30 pounds of effort utilizing an endless chain and cast iron reduction gears.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify opening sizes, tolerances and conditions are acceptable.

B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 92 00.

F. Install perimeter trim and closures.

G. Instruct Owner’s personnel in proper operating procedures and maintenance schedule.

3.4 ADJUSTING

A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.5 CLEANING

A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.

B. Remove labels and visible markings.

C. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION

SECTION 08 41 13 – ALUMINUM STOREFRONT

PART 1 - GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 SUMMARY

A. Related Documents: Conditions of the Contract, Division 1 - General Requirements, and Drawings apply to Work of this Section.

B. Section Includes:
1. Entrance and storefront systems, complete with reinforcing, fasteners, anchors and attachment devices.
2. Aluminum doors complete with hardware.
3. Accessories necessary to complete work.

C. Related Sections:
1. Section 01 40 00 - Quality Requirements.
2. Section 05 50 00 - Metal Fabrications.
3. Section 06 10 00 - Rough Carpentry.
4. Section 07 92 00 - Joint Sealants.
5. Section 08 71 00 - Door Hardware.
6. Section 08 81 00 - Glass and Glazing.

1.2 REFERENCES

A. Aluminum Association (AA):
1. DAF-45 Designation System for Aluminum Finishes.

B. American Architectural Manufacturers Association (AAMA):
1. 503.1 Test Method for Condensation Resistance of Windows, Doors and Glazed Wall Systems.
2. 701.2 Specifications for Pile Weatherstripping.
3. Manual #10 Care and Handling of Architectural Aluminum From Shop to Site.
4. SFM-1 Aluminum Storefront and Entrance Manual.

C. American National Standards Institute (ANSI):
1. A117.1 Safety Standards for the Handicapped.

D. American Society for Testing and Materials (ASTM):

1.	A36	Structural Steel.
2.	B209	Aluminum and Aluminum - Alloy Sheet and Plate.
3.	B221	Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
4.	B308	Aluminum-Alloy 6061-T6 Standard Structural Shapes, Rolled or Extruded.
5.	C509	Cellular Elastomeric Pre-formed Gasket and Sealing Material.
6.	C864	Dense Elastomeric Compression Seal Gaskets, Setting Blocks and Spacers.
7.	E283	Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors.
8.	E330	Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
9.	E331	Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

E. Federal Specifications (FS):

1.	TT-P-645A	Primer, Paint, Zinc Chromate, Alkyd Type.

F. Steel Structures Painting Council (SSPC):

1.	Paint 12	Cold-Applied Asphalt Mastic (Extra Thick Film).

1.3 SYSTEM REQUIREMENTS

A. Design Requirements:

1. Drawings are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage or moisture disposal.
2. Requirements shown by details are intended to establish basic dimension of units, sight lines and profiles of members.
3. Provide concealed fastening.
4. Provide entrance and storefront systems, including necessary modifications, to meet specified requirements and maintaining visual design concepts.
5. Attachment considerations are to take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
6. Anchors, fasteners and braces shall be structurally stressed not more than 50% of allowable stress when maximum loads are applied.
7. Provide for expansion and contraction without detriment to appearance or performance.
8. Assemblies shall be free from rattles, wind whistles and noise due to thermal and structural movement and wind pressure.

B. Performance Requirements:

1. Air infiltration: Air leakage through fixed light areas of storefront shall not exceed 0.06 cfm per square foot (0.0003 m3/sm2) of surface area when tested in accordance with ASTM E283 at differential static pressure of 6.24 psf (300 Pa).

2. Water infiltration: No uncontrolled water penetration when tested in accordance with ASTM E 331 at test pressure of 8.0 psf 380 Pa.

C. Thermal Requirements:
1. Framing systems shall accommodate expansion and contraction movement due to surface temperature differentials of 180 degrees Fahrenheit (82 degrees Celsius) without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance, or other detrimental effects.
2. Ensure doors function normally within limits of specified temperature range.

D. Structural Requirements, as measured in accordance with ANSI/ASTM E330:
1. Wind loads for exterior assemblies:
a. Basic loading:
1) [_____] psf acting inward.
2) [_____] psf acting outward.

2. Deflection: Maximum calculated deflection of any framing member in direction normal to plane of wall when subjected to specified design pressures shall not exceed 1/175 of its clear span.

E. Testing Requirements: Provide components that have been previously tested by an independent testing laboratory.

1.4 SUBMITTALS

A. General: Submit in accordance with Section 01 33 00.

B. Product Data:
1. Submit manufacturer's descriptive literature and product specifications.
2. Include information for factory finishes, hardware, accessories and other required components.
3. Include color charts for finish indicating manufacturer's standard colors available for selection.

C. Shop Drawings:

1. Submit shop drawings covering fabrication, installation and finish of specified systems.

2. Include following:
a. Fully dimensioned plans and elevations with detail coordination keys.
b. Locations of exposed fasteners and joints.

3. Provide detailed drawings of:
a. Composite members.
b. Joint connections for framing systems and for entrance doors.
c. Anchorage.
d. System reinforcements.
e. Expansion and contraction provisions.
f. Hardware, including locations, mounting heights, reinforcements and special installation provisions.
g. Glazing methods and accessories.
h. Internal sealant requirements as recommended by sealant manufacturer.

4. Schedule of finishes.

D. Samples:

1. Submit samples indicating quality of finish, in required colors, on alloys used for work, in sizes as standard with manufacturer.
2. Where normal texture or color variations are expected, include additional samples illustrating

range of variation.

E. Test Reports:

1. Standard Systems: Submit certified copies of previous test reports substantiating performance of system in lieu of re-testing. Include other supportive data as necessary.

F. Certificates:

1. Submit manufacturer's certification stating that systems are in compliance with specified requirements.

G. Qualification Data:

1. Submit installer qualifications verifying years of experience.
2. Include list of projects having similar scope of work identified by name, location, date, reference name and phone number.

H. Manufacturer's Instructions: Submit manufacturer's printed installation instructions.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility:

1. To ensure quality of appearance and performance, obtain materials for each system from either a single manufacturer or from manufacturer approved by each system manufacturer.

B. Installer Qualifications: Certified in writing by Contractor as qualified for installation of specified systems.

C. Perform Work in accordance with AAMA SFM-1 and manufacturer's written instructions.

D. Conform to requirements of ANSI A117.1 and local amendments.

1.6 DELIVERY, STORAGE AND HANDLING

A. Comply with requirements of Section 01 60 00.

B. Protect finished surfaces as necessary to prevent damage.

C. Do not use adhesive papers or sprayed coatings which become firmly bonded when exposed to sun.

D. Do not leave coating residue on any surfaces.

E. Replace damaged units.

1.7 WARRANTY

A. Provide warranties in accordance with the Contract General Conditions.

B. Provide written manufacturer's warranty, executed by company official, warranting against defects in materials and products for two (2) years from date of Substantial Completion.

C. Provide written installer's warranty, warranting work to be watertight, free from defective materials, defective workmanship, glass breakage due to defective design, and agreeing to replace components which fail within 1 year from date of Substantial Completion.

1. Warranty shall cover following:
   a. Complete watertight and airtight system installation within specified tolerances.

b. Completed installation will remain free from rattles, wind whistles and noise due to thermal and structural movement and wind pressure.

c. System is structurally sound and free from distortion.

d. Glass and glazing gaskets will not break or "pop" from frames due to design wind, expansion or contraction movement.

e. Glazing sealants and gaskets will remain free from abnormal deterioration or dislocation due to sunlight, weather or oxidation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers

1. YKK AP America, Inc.
2. Vista Wall Architectural Products
3. Kawneer
4. Oldcastle Building Envelope

B. Substitutions: Submit under provisions of Section 01 25 00, a minimum of 10 days prior to bid date.

C. Acceptable Entrance Doors:

1. Standard Duty Doors: Model 35D Medium Stile Door YKK AP with Mid-panel panic device system or equivalent by specified manufacturer.

D. Acceptable Storefront Framing Systems:

1. Framing System: YES 45 FI (2" x 4-1/2") YKK AP or equivalent by specified manufacturer.

2.2 FRAMING MATERIALS AND ACCESSORIES

A. Aluminum:

1. ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 5005-H34 for sheets; or other alloys and temper recommended by manufacturer appropriate for specified finish.

B. Internal Reinforcing:
1. ASTM A36 for carbon steel; or ASTM B308 for structural aluminum.
2. Shapes and sizes to suit installation.
3. Shop coat steel components after fabrication with alkyd type zinc chromate primer complying with FS TT-P-645.

C. Anchorage Devices:
1. Manufacturer's standard formed or fabricated steel or aluminum assemblies of shapes, plates, bars or tubes.

D. Fasteners:

1. Aluminum, non-magnetic stainless steel or other materials warranted by manufacturer to be non-corrosive and compatible with components being fastened.
2. Do not use exposed fasteners, except where unavoidable for application of hardware.

3. For exposed locations, provide countersunk Phillips head screws with finish matching items fastened.
4. For concealed locations, provide manufacturer's standard fasteners.
5. Provide nuts or washers of design having means to prevent disengagement; deforming of fastener threads is unacceptable.

E. Expansion Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.

F. Protective Coatings: Cold-applied asphalt mastic complying with SSPC-Paint 12, compounded for 30 mil (0.77 mm) thickness for each coat; or alkyd type zinc chromate primer complying with FS TT-P-645.

G. Glazing Gaskets:

1. Compression type design, replaceable, molded or extruded, of neoprene, or ethylene propylene diene monomer (EPDM).
2. Conform to ASTM C509 or C864.
3. Profile and hardness as required to maintain uniform pressure for watertight seal.
4. Provide in manufacturer's standard black color.

H. Weatherstripping:

1. Wool pile conforming to AAMA 701.2; or extruded EPDM elastomeric conforming to ASTM C509 or C864.
2. Provide EPDM or vinyl-blade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.

I. Internal Sealants: Types recommended by sealant manufacturer.

J. "Anti-Walk" Edge Blocking: "W" shaped EPDM blocks for use in keeping glazing material stationary under vibration or seismic loading.

K. Baffles (at weep holes): Type as recommended by system manufacturer and shown in published installation instructions.

2.3 GLASS AND GLAZING ACCESSORIES

A. Refer to Section 08 81 00.

2.4 FABRICATION

A. Coordination of Fabrication:

1. Check actual frame or door openings required in construction work by accurate field measurements before fabrication.
2. Fabricate units to withstand loads which will be applied when system is in place.

B. General:

1. Conceal fasteners wherever possible.
2. Reinforce work as necessary for performance requirements and for support to structure.
3. Separate dissimilar metals and aluminum in contact with concrete utilizing protective coating or pre-formed separators which will prevent contact and corrosion.
4. Comply with Section 08 81 00 for glazing requirements.

C. Aluminum Framing:

1. Provide members of size, shape and profile indicated, designed to provide for glazing from interior.
2. Fabricate frame assemblies with joints straight and tight fitting.
3. Reinforce internally with structural members as necessary to support design loads.

4. Maintain accurate relation of planes and angles, with hairline fit of contacting members.
5. Seal horizontals and direct moisture accumulation to exterior.
6. Provide flashings and other materials used internally or externally that are corrosive resistant, non-staining, non-bleeding and compatible with adjoining materials.
7. Provide manufacturer's extrusions and accessories to accommodate expansion and contraction due to temperature changes without being detrimental to appearance or performance.
8. Make provisions in framing for minimum edge clearance, nominal edge cover and nominal pocket width for thickness and type of glazing or infill used in accordance with recommendations of manufacturer and FGMA Glazing Manual.
9. Provide tight fitting, injection molded, plastic water deflectors at all intermediate horizontals.

D. Entrance Doors:

1. Fabricate with mechanical joints using internal reinforcing plates and shear blocks attached with fasteners and by welding.

2. Provide extruded aluminum glazing stops of [square] [beveled and mitered (for single glazing only)] design, [permanently anchored on security side and removable on opposite side.]

E. Hardware:

1. Receive hardware supplied in accordance with Section 08 71 00 and install in accordance with requirements of this Section.
2. Cut, reinforce, drill and tap frames and doors as required to receive hardware.
3. Comply with hardware manufacturer's templates and instructions.
4. Use concealed fasteners wherever possible.
5. Coordinate mid-panel panic device system with hardware at storefront doors to ensure compatibility.

F. Welding:

1. Comply with recommendations of the American Welding Society.
2. Use recommended electrodes and methods to avoid distortion and discoloration.
3. Grind exposed welds smooth and flush with adjacent surfaces; restore mechanical finish.

G. Flashings:

1. Form from sheet aluminum with same finish as extruded sections. Apply finish after fabrication. Material thickness as required to suit condition without deflection or "oil-canning".

2.5 FINISH

A. Manufacturer's standard colors as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and proceed with Work in accordance with Section 01 40 00.

B. Verify dimensions, tolerances and method of attachment with other Work.

3.2 INSTALLATION

A. Erection Tolerances:

1. Limit variations from plumb and level:
   a. 1/8 inch (3 mm) in 10 feet (3 M) vertically.
   b. 1/8 inch (3 mm) in 20 feet (6 M) horizontally.

2. Limit variations from theoretical locations: 1/4 inch (6 mm) for any member at any location.

3. Limit offsets in theoretical end-to-end and edge-to-edge alignment: 1/16 inch (2 mm) from flush surfaces not more than 2 inches (51 mm) apart or out-of-flush by more than 1/4 inch (6 mm).

B. Install doors and hardware in accordance with manufacturer's printed instructions.

C. Set units plumb, level and true to line, without warp or rack of frame.

D. Anchor securely in place, allowing for required movement, including expansion and contraction.

E. Separate dissimilar materials at contact points, including metal in contact with masonry or concrete surfaces, with bituminous paint or pre-formed separators to prevent contact and corrosion.

F. Seal perimeter members as shown on manufacturer’s installation instructions or as required for unique job conditions. Set other members with internal sealants and baffles as called for in manufacturer’s installation instructions. Use sealants as recommended by sealant manufacturer.

G. Coordinate installation of perimeter sealant and backing materials between assemblies and adjacent construction in accordance with requirements of Section 07 92 00.

H. Glazing: Refer to requirements of Section 08 81 00. Utilize "anti-walk" edge blocking on all vertical edges of glazing.

3.3 ADJUSTING

A. Test door operating functions. Adjust closing and latching speeds and other hardware in accordance with manufacturer's instructions to ensure smooth operation.

3.4 CLEANING

A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, foreign materials and other unsightly marks.

B. Clean metal surfaces exercising care to avoid damage.

END OF SECTION

SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware for:

   a. Swinging doors.
   b. Sliding doors.
   c. Gates.

2. Electronic access control system components
3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 Section “Alternates” for alternates affecting this section.
2. Division 06 Section “Rough Carpentry”
3. Division 06 Section "Finish Carpentry”
4. Division 07 Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:

   a. “Metal Doors and Frames”
   b. “Flush Wood Doors”
   c. “Stile and Rail Wood Doors”
   d. “Interior Aluminum Doors and Frames”
   e. "Aluminum-Framed Entrances and Storefronts"
   f. “Stainless Steel Doors and Frames”
   g. “Special Function Doors”
   h. "Entrances”

6. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.
7. Division 26 “Electrical” sections for connections to electrical power system and for low-voltage wiring.
8. Division 28 “Electronic Safety and Security” sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL - Underwriters Laboratories

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:

a. Comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.
b. Review drawings and Sections from related trades to verify compatibility with specified hardware.
c. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:

a. Wiring Diagrams: For power, signal, and control wiring and including:
   1) Details of interface of electrified door hardware and building safety and security systems.
   2) Schematic diagram of systems that interface with electrified door hardware.
   3) Point-to-point wiring.
   4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.

   a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule:

   a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
   b. Submit with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
   c. Indicate complete designations of each item required for each opening, include:
      1) Door Index: door number, heading number, and Architect's hardware set number.
      2) Quantity, type, style, function, size, and finish of each hardware item.
      3) Name and manufacturer of each item.
      4) Fastenings and other pertinent information.
      5) Location of each hardware set cross-referenced to indications on Drawings.
      6) Explanation of all abbreviations, symbols, and codes contained in schedule.
      7) Mounting locations for hardware.
      8) Door and frame sizes and materials.
      9) Degree of door swing and handing.
      10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

5. Key Schedule:

   a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
   b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
   c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
   d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
   e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
   f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory or shop prepared for door hardware installation.

C. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:

a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
b. Include warranties for specified door hardware.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:

a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
b. Catalog pages for each product.
c. Factory order acknowledgement numbers (for warranty and service)
d. Name, address, and phone number of local representative for each manufacturer.
e. Parts list for each product.
f. Final approved hardware schedule edited to reflect conditions as installed.
g. Final keying schedule
h. Copies of floor plans with keying nomenclature
i. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
j. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

1. Submit a written report of the results of functional testing and inspection for fire door assemblies, in compliance with NFPA 80.

a. Written report to be provided to the Owner and be made available to the Authority Having Jurisdiction (AHJ).
b. Report to include the door number for each fire door assembly, door location, door and frame material, fire rating, and summary of deficiencies.

2. Submit a written report of the results of functional testing and inspection for required egress door assemblies, in compliance with NFPA 101.

a. Written report to be provided to the Owner and be made available to the Authority Having Jurisdiction (AHJ).
b. Report to include the door number for each required egress door assembly, door location, door and frame material, fire rating, and summary of deficiencies.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.

a. Warehousing Facilities: In Project's vicinity.
b. Scheduling Responsibility: Preparation of door hardware and keying schedules.
c. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies like those indicated for this Project.

d. Coordination Responsibility: Assist in coordinating installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.
    1) Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.

2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

    a. For door hardware: DHI certified AHC or DHC.
    b. Can provide installation and technical data to Architect and other related subcontractors.
    c. Can inspect and verify components are in working order upon completion of installation.
    d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.

4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Fire-Rated Door Openings:

    a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
    b. Provide only items of door hardware that are listed products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

2. Smoke and Draft Control Door Assemblies:

    a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
    b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

3. Electrified Door Hardware

    a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

4. Accessibility Requirements:

    a. Comply with governing accessibility regulations cited in “REFERENCES” article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference

a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
   1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
   2) Preliminary key system schematic diagram.
   3) Requirements for key control system.
   4) Requirements for access control.
   5) Address for delivery of keys.

2. Pre-installation Conference

   a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   b. Inspect and discuss preparatory work performed by other trades.
   c. Inspect and discuss electrical roughing-in for electrified door hardware.
   d. Review sequence of operation for each type of electrified door hardware.
   e. Review required testing, inspecting, and certifying procedures.
   f. Review questions or concerns related to proper installation and adjustment of door hardware.

3. Electrified Hardware Coordination Conference:

   a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer’s original packaging.

C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where existing doors, frames and/or hardware are to remain, field verify existing functions, conditions and preparations and coordinate to suit opening conditions and to provide proper door operation.

1.07 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.

1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer’s published listings.

a. Mechanical Warranty
   1) Locks
      a) Schlage ND Series: 10 year
   2) Exit Devices
      a) Von Duprin: 3 year
   3) Closers
      a) LCN 4000 Series: 30 year

b. Electrical Warranty
   1) Exit Devices
      a) Von Duprin: 1 year

1.08 MAINTENANCE

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: “No Substitute.”

1. Where “No Substitute” is noted, submittals and substitution requests for other products will not be considered.

B. Approval of manufacturers and/or products other than those listed as “Scheduled Manufacturer” in the individual article for the product category shall be in accordance with QUALITY ASSURANCE article, herein.

C. Approval of products is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru bolts are required.
4. Install hardware with fasteners provided by hardware manufacturer.

B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

C. Cable and Connectors:

1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Ives 5BB series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.

2. Provide five knuckle, ball bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:

    a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
    b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:

    a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
    b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. 2 inches or thicker doors:

    a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
    b. Interior: Heavy weight, steel, 5 inches (127 mm) high

6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
9. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

    a. Steel Hinges: Steel pins
    b. Non-Ferrous Hinges: Stainless steel pins
    c. Out-Swinging Exterior Doors: Non-removable pins
    d. Out-Swinging Interior Lockable Doors: Non-removable pins
    e. Interior Non-lockable Doors: Non-rising pins

10. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 ELECTRIC POWER TRANSFER

A. Manufacturers:

1. Scheduled Manufacturer and Product:

    a. Von Duprin EPT-10

B. Requirements:

1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer’s template and UL requirements, unless interference with operation of door or other hardware items.

2.05 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Schlage ND series

B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets.
8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.

a. Lever Design: RHO.

2.06 DEADBOLTS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Schlage B500 Series

B. Requirements:

1. Provide grade 2 deadbolt series conforming to ANSI/BHMA A156.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide deadbolts with standard 2-3/4 inches (70 mm) backset. Provide 2-3/8 inches (60 mm) where noted or if door or frame detail requires. Provide deadbolt with full 1-inch (25 mm) throw, constructed of steel alloy.
4. Provide manufacturer’s standard strike.

2.07 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Von Duprin 99/33A series

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to “KEYING” article, herein.
3. Provide grooved touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.

6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
7. Provide flush end caps for exit devices.
8. Provide exit devices with manufacturer's approved strikes.
9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
11. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
14. Provide electrified options as scheduled.
15. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
16. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.08 ELECTRIC STRIKES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

a. Von Duprin 6000 Series.

B. Requirements:

1. Provide electric strikes designed for use with type of locks shown at each opening.
2. Provide electric strikes UL Listed as burglary resistant that are tested to a minimum endurance test of 1,000,000 cycles.
3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

2.09 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer and Product:

a. Schlage restricted Everest 29 Primus large format interchangeable core.

2. Acceptable Manufacturers and Products:

a. No Substitute

B. Requirements:

1. Provide cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.

C. Construction Keying:

1. Replaceable Construction Cores.

a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
1) 3 construction control keys
2) 12 construction change (day) keys.

b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2.10 KEYING

A. Scheduled System:

1. Provide cylinders/cores keyed into Owner's existing factory registered keying system. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.

a. Master Keying system as directed by the Owner.

2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
3. Provide keys with the following features:

a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
b. Patent Protection: Keys and blanks protected by one or more utility patent(s).
c. Geographically Exclusive: Where High Security or Security cylinders/cores are indicated, provide nationwide, geographically exclusive key system complying with the following restrictions.

4. Identification:

a. Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
b. Identification stamping provisions must be approved by the Architect and Owner.
c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
d. Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

5. Quantity: Furnish in the following quantities.

a. Change (Day) Keys: 3 per cylinder/core.
b. Permanent Control Keys: 3.
c. Master Keys: 6.

2.11 KEY CONTROL SYSTEM

A. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.

    a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
    b. Provide hinged-panel type cabinet for wall mounting.

2.12 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

    a. LCN 4040XP series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter with 5/8-inch (16 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.13 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:

    a. Ives.

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.14 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.15 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:

a. Ives

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.16 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer:

a. Zero International

B. Requirements:

1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.17 FINISHES

A. Finish: As Scheduled.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.

B. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

D. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
4. Installation Guide for Doors and Hardware: DHI TDH-007-20

B. Install each hardware item in compliance with manufacturer’s instructions and recommendations, using only fasteners provided by manufacturer.

C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

D. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

H. Lock Cylinders:

1. Install construction cores to secure building and areas during construction period.
2. Replace construction cores with permanent cores as indicated in keying section.
3. Furnish permanent cores to Owner for installation.

I. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.
4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
5. Connections to panel interface modules, controllers, and gateways.
6. Testing and labeling wires with Architect’s opening number.

J. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

K. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

L. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

M. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.

N. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

O. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

P. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

Q. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

R. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 FIELD QUALITY CONTROL

A. Inspection and Testing:

1. Provide functional testing and inspection of fire door assemblies by a qualified person in accordance with NFPA 80.

a. Schedule fire door assembly inspection within 90 days of Substantial Completion of the Project.
b. Submit a signed, written final report as specified in Paragraph 1.03.E.1.

c. Correct all deficiencies and schedule a reinspection of fire door assemblies noted as deficient on the inspection report.
d. Inspector to reinspect fire door assemblies after repairs are made.

2. Provide inspection of required egress door assemblies by a qualified person in accordance with NFPA 101.

a. Schedule egress door assembly inspection within 90 days of Substantial Completion of the Project for the required openings.
b. Submit a signed, written final report as specified in Paragraph 1.03.E.2.
c. Correct all deficiencies and schedule a reinspection of egress door assemblies noted as deficient on the inspection report.
d. Inspector to reinspect required egress door assemblies after repairs are made.

3.04 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.05 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer’s instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.06 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier’s responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

D. Hardware Sets:

118551 OPT0386373-V1

HARDWARE SET # 001

For use on Door #(s):
120A *120B* *120C* *120D* *120E*

EACH RU DOOR TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CYLINDER	AS REQUIRED		626	B/O
1	EA	PRIMUS XP CORE	20-740-XP CKC EV29 T		626	SCH
1	EA	DOOR CONTACT	BY SECURITY CONTRACTOR			
1			BALANCE OF HARDWARE BY DOOR MANUFACTURER			

- COORDINATE HARDWARE / LOCKING REQUIREMENT WITH OVERHEAD DOOR MFR PRIOR TO BID. OMIT CYLINDER/CORE AS REQUIRED.
- DOOR STATUS MONITORED.

HARDWARE SET # 103

For use on Door #(s):
101 *104* *105*

EACH SGL DOOR TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE LOCK	ND53TD RHO		626	SCH
1	EA	PRIMUS XP CORE	20-740-XP CKC EV29 T		626	SCH
1	EA	FLOOR/WALL STOP	FS436/WS406CCV AS REQ		626	IVE
3	EA	SILENCER	SR64 (PERIMETER SEAL BY FRAME MFR AT ALF)		GRY	IVE

HARDWARE SET # 203

For use on Door #(s):
107

EACH SGL DOOR TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO		626	SCH
1	EA	PRIMUS XP CORE	20-740-XP CKC EV29 T		626	SCH
1	EA	FLOOR/WALL STOP	FS436/WS406CCV AS REQ		626	IVE
3	EA	SILENCER	SR64 (PERIMETER SEAL BY FRAME MFR AT ALF)		GRY	IVE

HARDWARE SET # 205

For use on Door #(s):
110 *119* *120*

EACH SGL DOOR TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	STOREROOM LOCK	ND80TD RHO X 7/8" LTC		626	SCH
1	EA	PRIMUS XP CORE	20-740-XP CKC EV29 T		626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH X MTG PLT/SPCR/BRKT AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142A DW + 4" (OMIT @ COVERED AREAS)		AA	ZER
1	EA	GASKETING SET	188S PSA H & J		BK	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	65A		A	ZER

HARDWARE SET # 341

For use on Door #(s):
118

EACH SGL DOOR TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC		626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA X MTG PLT/SPCR/BRKT AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	FLOOR/WALL STOP	FS436/WS406CCV AS REQ		626	IVE
1	EA	GASKETING	488SBK PSA H & J		BK	ZER

HARDWARE SET # 401G

For use on Door #(s):
117

EACH SGL DOOR TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA X MTG PLT/SPCR/BRKT AS REQ		689	LCN
1	EA	FLOOR/WALL STOP	FS436/WS406CCV AS REQ		626	IVE
1	EA	GASKETING	488SBK PSA H & J		BK	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	545A (COORDINATE WITH SILL CONDITIONS)		A	ZER

HARDWARE SET # 403

For use on Door #(s):
102 *103*

EACH SGL DOOR TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	FLOOR/WALL STOP	FS436/WS406CCV AS REQ		626	IVE
3	EA	SILENCER	SR64 (PERIMETER SEAL BY FRAME MFR AT ALF)		GRY	IVE

HARDWARE SET # 403S

For use on Door #(s):
116

EACH SGL DOOR TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	OH STOP	900S SERIES X SIZE & MOUNTING AS REQ		630	GLY
3	EA	SILENCER	SR64 (SEALS BY FRAME MFR @ ALF)		GRY	IVE

HARDWARE SET # 503

For use on Door #(s):
115

EACH SGL DOOR TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO		626	SCH
1	EA	PRIMUS XP CORE	20-740-XP CKC EV29 T		626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	FLOOR/WALL STOP	FS436/WS406CCV AS REQ		626	IVE
3	EA	SILENCER	SR64 (SEALS BY FRAME MFR @ ALF)		GRY	IVE

HARDWARE SET # 711CA

For use on Door #(s):
109

EACH SGL DOOR TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY		628	IVE
1	EA	PANIC HARDWARE	99-NL-SNB		626	VON
1	EA	RIM CYLINDER	20-057 ICX W/CONST. CORE		626	SCH
1	EA	PRIMUS XP CORE	20-740-XP CKC EV29 T		626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH X MTG PLT/SPCR/BRKT AS REQ		689	LCN
1	SET	SEAL	PERIMETER SEAL BY ALUM FRAME MFR			

HARDWARE SET # 801

For use on Door #(s):
111 *112*

EACH SGL DOOR TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	PUSH PLATE	8200 6" X 16"		630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"		630	IVE
1	EA	SURFACE CLOSER	4040XP RW/PA X MTG PLT/SPCR/BRKT AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	FLOOR/WALL STOP	FS436/WS406CCV AS REQ		626	IVE
3	EA	SILENCER	SR64 (SEALS BY FRAME MFR @ ALF)		GRY	IVE

HARDWARE SET # C715

For use on Door #(s):
109A *113B*

EACH SGL DOOR TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	POWER TRANSFER	EPT10		689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL-SNB 24 VDC		626	VON
1	EA	RIM CYLINDER	20-057 ICX W/CONST. CORE		626	SCH
1	EA	PRIMUS XP CORE	20-740-XP CKC EV29 T		626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH X MTG PLT/SPCR/BRKT AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142A DW + 4" (OMIT @ COVERED AREAS)		AA	ZER
1	EA	GASKETING SET	188S PSA H & J		BK	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	65A		A	ZER
1	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR			
1	EA	DOOR CONTACT	679-05 TYPE AS REQ - BY SECURITY CONTRACTOR		BLK	SCE
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR			

- INGRESS VIA CARD READER OR MANUAL KEY OVERRIDE. FREE EGRESS AT ALL TIMES. FAIL-SECURE.
- DOOR STATUS MONITORED.

HARDWARE SET # C715A

For use on Door #(s):
100

EACH SGL DOOR TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	112XY EPT		628	IVE
1	EA	POWER TRANSFER	EPT10		689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL-SNB 24 VDC		626	VON
1	EA	RIM CYLINDER	20-057 ICX W/CONST. CORE		626	SCH
1	EA	PRIMUS XP CORE	20-740-XP CKC EV29 T		626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH X MTG PLT/SPCR/BRKT AS REQ		689	LCN
1	SET	SEAL	PERIMETER SEAL BY ALUM FRAME MFR			
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	65A		A	ZER
1	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR			
1	EA	DOOR CONTACT	7764 - BY SECURITY CONTRACTOR		628	SCE
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR			

- INGRESS VIA CARD READER OR MANUAL KEY OVERRIDE. FREE EGRESS AT ALL TIMES. FAIL-SECURE.
- DOOR STATUS MONITORED.

HARDWARE SET # C715R

For use on Door #(s):
113A

EACH SGL DOOR TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	POWER TRANSFER	EPT10		689	VON
1	EA	ELEC FIRE EXIT HDW	RX-QEL-99-NL-F-SNB 24 VDC		626	VON
1	EA	RIM CYLINDER	20-057 ICX W/CONST. CORE		626	SCH
1	EA	PRIMUS XP CORE	20-740-XP CKC EV29 T		626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH X MTG PLT/SPCR/BRKT AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142A DW + 4" (OMIT @ COVERED AREAS)		AA	ZER
1	EA	GASKETING SET	188S PSA H & J		BK	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	65A		A	ZER
1	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR			
1	EA	DOOR CONTACT	679-05 TYPE AS REQ - BY SECURITY CONTRACTOR		BLK	SCE
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR			

- INGRESS VIA CARD READER OR MANUAL KEY OVERRIDE. FREE EGRESS AT ALL TIMES. FAIL-SECURE.
- DOOR STATUS MONITORED.

HARDWARE SET # CE201

For use on Door #(s):
100A *108* *113*

EACH SGL DOOR TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO		626	SCH
1	EA	PRIMUS XP CORE	20-740-XP CKC EV29 T		626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE CON 12/16/24/28 VAC/VDC		630	VON
1	EA	SURFACE CLOSER	4040XP RW/PA X MTG PLT/SPCR/BRKT AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	FLOOR/WALL STOP	FS436/WS406CCV AS REQ		626	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS AT NON-RATED DOORS)		BK	ZER
1	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR			
1	EA	DOOR CONTACT	679-05 TYPE AS REQ - BY SECURITY CONTRACTOR		BLK	SCE
1	EA	SENSOR/RX SWITCH - AS REQ	BY SECURITY CONTRACTOR			
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR			

- INGRESS VIA CARD READER OR MANUAL KEY OVERRIDE. FREE EGRESS AT ALL TIMES. FAIL-SECURE.
- DOOR STATUS MONITORED.

END OF SECTION

SECTION 08 81 00 — GLASS AND GLAZING

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Glazing for hollow metal doors and frames.

B. Glazing for aluminum frames.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Hollow metal doors and frames.

B. Aluminum entrances and storefronts.

C. Aluminum window systems.

1.4 SUBMITTALS

A. Submit manufacturer’s literature with material and performance descriptions for each type of glass, sealant and glazing accessories.

B. Submit detailed shop drawings indicating locations, installation and sealing methods.

C. Submit 12” x 12” physical samples of each type of tinted or wire glass and panel.

D. Obtain approved shop drawings from hollow metal supplier, aluminum frame supplier, plastic laminate door supplier.

E. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

B. Warranted defects shall include but not necessarily be limited to water infiltration, air infiltration, glass failure due to improper sizing or installation, sealant failure.

1.6 QUALITY ASSURANCE

A. Glazing contractor shall have a minimum of 3 years experience in the installation of glazing products for projects of similar size and scope as this project.

B. Each piece of glass shall bear manufacturer's label indicating type.

1.7 DELIVERY, STORAGE AND HANDLING

A. Do not deliver glass or panels to the jobsite until openings are ready for glazing.

B. Deliver glass and panels in manufacturer's original protective packaging. Store in a dry, well ventilated area and take care to prevent condensation on the materials. Keep glass faces separated.

1.8 MINIMUM COMPLIANCE STANDARDS

A. SAFETY: Contractor shall be responsible for meeting all Federal and applicable code requirements for types and locations of glazing regardless of drawing indications. Comply with the current standards of the Consumer Products Safety Commission and Federal Standard 16 CFR 1201 Federal Architectural Glazing Materials Safety Standard.

B. INSTALLATION: Comply with recommendations of Flat Glass Marketing Association – FGMA Glazing Manual.

PART 2 - PRODUCTS

2.1 GENERAL

A. GLAZING SHEETS: Glazing materials shall conform to the highest qualities as specified in the following standards:
   1. Float glass: FS DD-G-451d and ASTM C1036.
   2. Float glass, heat strengthened: ASTM C1036 and ASTM C1048.
   3. Float glass, tempered: FS DD-G-1403B and ASTM C1036, ASTM C1048, ANSI Z97.1, and Consumer Product Safety Commission 16 CFR 1201.
   4. Wired glass: FS DD-G-451, ASTM C1036 and ANSI Z97.1. Misco diamond pattern.
   5. Insulating glass: ASTM C1036. Meet industry standards set by the Sealed Insulating Glass Manufacturers Association (SIGMA).

B. MISCELLANEOUS
   1. Glazing sealants: FS TT-S-1543A (silicone rubber); FS TT-S-230 (synthetic rubber); FS TT-S-001657 (butyl rubber).
   2. Glazing tape: Architectural Aluminum Manufacturer's Association.

2.2 MANUFACTURERS

A. GLASS:
1. Guardian
2. PPG Industries
3. Pilkington.

B. TEMPERING, LAMINATING AND HEAT STRENGTHENING:
1. Oldcastle
2. Trulite

C. WIRE GLASS:
1. Pilkington
2. PPG Industries

D. GLAZING TAPE:
1. TREMCO – tape, shims, setting blocks, edge blocking.

E. GLAZING SEALANT:
1. TREMCO,
2. General Electric.

2.3 MATERIALS: Types as indicated in the drawings.

A. TEMPERED GLASS: 1/4" clear and solar tint float glass tempered by the vertical or horizontal process and meeting requirements of FS DD-G-1403B.

B. WIRE GLASS: Shall be 1/4" thick. Polish plate glass reinforced with diamond pattern wire mesh No. 24 gauge minimum, with a mesh not larger than 1”.

C. HOLLOW METAL FRAME AND DOOR GLAZING SYSTEM:
1. Glazing: 1/4” Tempered.
2. Glazing tape: 1/8” x 3/8” x continuous preshimmed butyl tape; Tremco 440.
3. Setting blocks: Neoprene or EPDM in minimum 4” lengths.
4. Edge blocking: Neoprene or EPDM in minimum 4” lengths and sized to allow for 1/8” clear expansion at both vertical edges.
5. Add sealant at exterior glazing.

2.4 INSULATING GLASS

A. Solar Control Tinted Insulated Units
1. Conformance: ASTM C 1172 and complying with testing requirements in CPSC 16CFR-1201 for Category II materials.
2. Overall Thickness: 1 inch (25 mm)
3. Outboard Lite: Bronze float glass.
   a. Tinted Float Glass: ASTM C 1036, Type I, Class 2, Quality q3.
   b. Glass Thickness: 1/4 inch (6 mm).
   c. Heat Treatment: Fully Tempered, ASTM C 1048, Kind FT
4. Interspace: ½ inch (12 mm) hermetically sealed air
5. Inboard Lite: Clear float glass.
   a. Clear Float Glass: ASTM C 1036, Type I, Class 1, Quality q3.
   b. Glass Thickness: 1/4 inch (6 mm).
   c. Heat Treatment: Fully Tempered, ASTM C 1048, Kind FT
6. Sealant: Approved by glass manufacturer.

7. Nominal shading coefficient: 0.53

PART 3 - EXECUTION

3.1 INSTALLATION

A. GENERAL: Install glass without warping, binding or stress. Allow for expansion and contraction of glass due to temperature changes. Do not install sealant with surfaces or ambient temperature below 40 degrees F.

B. HOLOW METAL FRAMES AND DOORS:
1. Ensure that finish painting of doors and frames is complete.
2. Cut glazing tape to length and install against permanent stop, flush with face of stop.
3. Place setting blocks at 1/4 points.
4. Rest glass on setting blocks and press against stop for full contact and adhesion at perimeter.
5. Place continuous glazing tape on opposite-face perimeter of glass in same manner described above. Install removable stop; avoid displacement of tape; and exert pressure on tape for full continuous contact.
6. Knife trim excess of protruding tape (leave recessed for sealant at exterior glazing).
7. Do not touch glass to metal.

C. PLASTIC LAMINATE DOORS:
1. Follow procedures specified above for non-rated doors. Metal stops provided by door manufacturer.
2. Follow recommendations of door manufacturer for rated doors. Metal stops provided by door manufacturer.

D. ALUMINUM FRAMES: Follow door and frame manufacturer’s printed instructions for glazing gasketed systems. Provide watertight installation at exterior systems.

3.2 CLEANING AND PROTECTION

A. During glazing operations, provide sufficient stick-on safety labels or hang streamers on new glazing.

B. Prior to project closeout, thoroughly clean all glazing inside and out with commercial glass cleaner.

C. Reglaze any openings where glass is chipped, broken, scratched, pitted or stained.

END OF SECTION

SECTION 08 91 00 - LOUVERS AND VENTS

PART 1 – GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 SUMMARY

A. Section Includes:

1. Fixed, prefinished formed-metal louvers.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for building wall vents (brick vents) into masonry.
2. Division 09 Section "Exterior Painting.

1.2 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.

C. Vertical Louver: Louver with vertical blades; i.e., the axes of the blades are vertical.

D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

E. Storm-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.

B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Design to withstand TDI requirements for Inland I conditions.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
2. Show mullion profiles and locations.

C. Samples for Initial Selection: For units with factory-applied color finishes.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified. Include testing information for TDI impact requirements.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.3, "Structural Welding Code - Sheet Steel."

C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221 , Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Aluminum Castings: ASTM B 26/B 26M, Alloy 319.

D. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
2. For color-finished louvers, use fasteners with heads that match color of louvers.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Interior flange unless otherwise indicated.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less.

1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.

F. Provide subsills made of same material as louvers.

G. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.3 STATIONARY, EXTRUDED-ALUMINUM LOUVERS

A. Louver Construction and Operation: Provide louvers with extruded-aluminum frames and blades not less than 0.080-inch nominal thickness.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Air Balance Inc.; a Mestek company.
b. Air Flow Company, Inc.
c. Airolite Company, LLC (The).
d. All-Lite Architectural Products.
e. American Warming and Ventilating, Inc.; a Mestek company.
f. Arrow United Industries; a division of Mestek, Inc.
g. Carnes Company, Inc.
h. Cesco Products; a division of Mestek, Inc.
i. Construction Specialties, Inc.
j. Dowco Products Group; Safe-Air of Illinois, Inc.
k. Greenheck Fan Corporation.
l. Industrial Louvers, Inc.
m. Louvers & Dampers, Inc.; a division of Mestek, Inc.
n. NCA Manufacturing, Inc.
o. Metal Form Manufacturing Inc.
p. Reliable Products, Inc.
q. Ruskin Company; Tomkins PLC.
r. United Enertech Corp.
s. Vent Products Company, Inc.

2. Louver Depth: 4 inches, overall.

2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Insect screening.

B. Secure screen frames to louver frames with machine screws with heads finished to match louver,

spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide factory applied finish from manufacturer's complete selection of available colors.

2.6 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory,

make required alterations, and refinish entire unit or provide new units.

F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.

B. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

D. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 09 20 00 — LATH AND PLASTER

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide and install plaster lathing and accessories, three coat stucco system with floated finish as indicated in the drawings and specified herein.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Metal studs and gypsum sheathing.

B. Insulation

C. Dampproofing and waterproofing.

D. Painting

1.4 SUBMITTALS

A. Submit manufacturer's product data describing masonry mix, waterproofing additive, oriental stucco, lath and metal accessories.

B. Submit mix design.

C. Submit a 12" x 12" lath and plaster, metal edged sample for each type of plaster and each finish texture for Architect's approval.

D. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

B. Warranted defects shall include but not necessarily be limited to cracking, water infiltration, loss of adhesion, spalling or discoloration.

1.6 QUALITY ASSURANCE

A. Plaster contractor shall have a minimum of 3 years experience in the installation of plaster systems for projects of similar size and scope as this project.

PART 2 - PRODUCTS

2.1 LATHING MATERIALS

A. CHANNELS: 16 gauge, cold rolled pressed steel, galvanized. Flanges minimum 7/16" wide. Minimum weight shall be 475 pounds per 1000 lineal feet for 1-1/2" channels and 300 pounds per 1000 lineal feet for 3/4" channels.

B. METAL LATH: Copper - alloy steel as follows: 1. Interior dry areas: Flat expanded diamond mesh at ceilings and soffits. Self- furring type at sheathed walls. Galvanized or painted finish. Minimum 3.4 lbs. per square yard. 2. Exterior and interior wet areas: Flat expanded diamond mesh at ceilings and soffits. Self-furring type at sheathed walls. Galvanized finish meeting requirements of FS QQ-Z-325C, Type 1. Minimum 3.4 lbs. per square yard.

C. WIRE: Annealed galvanized metal wire. Minimum 18 gauge tie wire; minimum 8 gauge hanger wire.

D. LATHING ACCESSORIES: Galvanized for interior dry areas; solid zinc alloy for exterior work.

1. Casino Beads: MUcor #66 with expanded metal flange, 26 gauge.
2. Corner Beads: U.S.G. NO. 4-R, or approved equal, 26 gauge expansion type.
3. Control Joints: No. 75 per U.S.G.
4. Expansion Joints: No. 40 zinc expansion flange type per Keene.

E. Wire clips for attachment of furring channels to runner channels shall be formed hairpin clips, 8 gauge galvanized soft steel wire.

F. METAL STUDS: Provided and installed under another section of these specifications

2.2 PLASTERING MATERIALS

A. REINFORCING: Alkaline resistant fiberglass strands, 1/2".

B. PORTLAND CEMENT: ASTM C-150, Type I, white for finish coat.

C. SAND: ASTM C-144, red torpedo sand for scratch and brown coats.

D. MASONRY MIX: Pre-mixed dry masonry mortar mix meeting requirements of A.S.T.M. C-91, Type N, as manufactured by Trinity, Ideal, TXI or Lonestar.

E. FINISH: "Oriental Exterior" stucco as manufactured by United States Gypsum Company, or approved equal. Colors shall be as selected by the Architect. Deliver to job in manufacturer's original packages, with labels intact, seals unbroken. Prepare stucco finish coat for application by mixing with water only.

F. WATERPROOFING: "Hvdrocide" as manufactured bv Sonneborn.

G. WATER: Clean, potable and free from any amounts of mineral and organic substances that would affect set of Plaster.

H. No asbestos or admixtures.

2.3 MIXES

A. SCRATCH COAT:

1. 1 sack Portland cement.
2. 2 sacks masonry mix.
3. 9 cu. ft. sharp sand
4. 1-1/2 lbs. fiberglass strands.

B. BROWN COAT:

1. 1 sack Portland cement.
2. 2 sacks masonry mix.
3. 10 cu. ft. sharp sand.
4. 1-1/2 lbs. fiberglass strands
5. Integral waterproofing per manufacturer's recommendations

C. Plaster mixes shall comply with ASTM C926.

PART 3 - EXECUTION

3.1 GENERAL

A. Install furring, lathing, and all plaster work level and plumb, true and rigid. Ensure that all work to be concealed by plaster has been completed and inspected prior to beginning plaster work.

B. Obtain access panels, frames, or other built-in items from the appropriate trades before beginning plaster work.

C. Exercise precautions to prevent damage to work of other crafts. Plaster droppings on glass or aluminum surfaces shall be immediately removed with clean water and soft cloths.

3.2 EXTERIOR PLASTER (STUCCO)

A. All exterior work and interior wet areas to have Portland Cement Finish "Oriental Exterior" sand finish 3/16" to 1/4" thick finished coat, texture as approved by Architect. Color and texture shall be uniform.

B. Exterior plaster and interior wet areas to include integral waterproofing, galvanized lath, and pure zinc accessories.

3.3 SUSPENDED CEILING & SOFFIT INSTALLATION

A. Install suspended ceilings or exterior soffits in indicated locations. Unless otherwise indicated, suspension system shall consist of *1-1/2"* runner channels, *3/4"* furring channels, suspended from structure above by galvanized hanger wires.

B. Space hanger wire 48" maximum in either direction for interior ceilings. Maximum 36" in either direction for stucco soffits.

C. Space runner channels 48" on center maximum for interior plaster ceilings, supported from resilient hangers; space 36" on center maximum for plaster soffits

D. Wrap each hanger wire twice around channels; secure by at least 3 turns around itself. Space furring channels 12-1/2" on center maximum and at right angles to runners.

E. Secure to runner channels with wire clips or saddle tied with 2 strands of 16 gauge tie wire giving wire ends 3 twists.

F. Isolate penetrations (such as light fixtures) with control joints and reinforce with furring channels

3.4 METAL LATH & ACCESSORIES

A. Apply metal lath to form true surfaces, straight, without sags or buckles, with long dimension at right angles to direction of supports. Secure lath to supports at 6" intervals. Secure side laps on ceilings to supports; tie at 6" intervals between supports. Lap lath at sides at least *1/2".* Lap lath at ends at least 1", stagger laps; and locate only over supports. Break end joints of lath on alternate sheets of lath. Lath ties shall have a minimum of three complete turns.

B. Provide corner beads on external plaster corners and where indicated. Corner beads shall be single lengths where length of corner does not exceed standard stock lengths. Miter or cope beads at corners; fasten securely with tie wire spaced 8" maximum; stagger on two wings.

C. Install casing beads (stops) where plaster abuts other surfaces, at edges of plaster panels, and elsewhere as indicated. Set casing beads level, true to line. Install casing beads in lengths as long as practicable, with joints in straight runs aligned with suitable formed splices. Secure casing beads to metal lath with tie wire spaced 8" maximum.

D. Provide expansion joints in exterior and interior plaster as shown. Expansion joints shall be in single lengths where possible. Secure expansion joints to metal lath with tie wire; space ties or nail anchors not over 8" apart.

E. Provide control joints in exterior and interior plaster between expansion joints so that no panel dimension exceeds 12' or 120 square feet of area.

3.5 APPLICATION

A. Maintain temperature of at least 40 degrees F. in building prior to plaster application, until it is dry. Plaster shall be three coat work on all bases. Plaster thickness from plaster base to finished plaster surface shall be as noted on drawings but shall be a minimum thickness of 3/4" at its thinnest point. Do not combine scratch and brown coats. No irregularities shall show in finished surface, such as "cat faces", streaks, waviness, trowel, float or brush marks. Finished surfaces shall be true, uniform in texture and finish.

B. Apply scratch coat with sufficient pressure to force mortar through mesh and key firmly to lath. Scratch to form rough surfaces. Apply brown coat 48 hours after scratch coat has set; bring out to grounds; straighten to true surface with rod, darby; leave rough, and ready for finish coat.

C. Apply finish over base coat which has been wetted evenly by brushing or spraying. Apply finish coat not sooner than seven (7) days after brown coat. Provide light sand finish per approved sample.

D. Keep plaster moist for the curing period between coats. Limit thickness *of* scratch, and brown coat to maximum 3/8" each.

3.6 PLASTER CUTTING & PATCHING

A. Execute after other work is in place, and after painter has applied priming coat. Thoroughly rake out, or cut out, moisten and fill with finishing material. Float finish with adjoining work. Point up around fixtures, outlet boxes, switch plates, fittings, piping and other appliances abutting or extending into plastering.

3.7 FINISH PLASTER PROTECTION

A. Provide protection against damage for finished plaster work. Protect plastering from freezing or premature drying. Execute no plastering work in cold weather, except where work is adequately protected and proper temperatures are maintained to prevent freezing.

END OF SECTION

SECTION 09 21 16 — INTERIOR DRYWALL SYSTEMS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide and install acoustical batt insulation within interior drywall partitions.

B. Provide and install all interior drywall systems including light gauge metal studs and tracks, gypsum wall board and finishing systems, suspended gypsum board ceilings and soffits, furred gypsum board.

C. Provide and install troweled firestopping system at drywall ceiling and wall penetrations at rated walls.

D. Provide and install specified corner guards at each wall corner.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Painting

B. Door frames

C. Carpentry (wood blocking)

D. Plaster on metal studs

E. Mechanical, electrical and plumbing penetrations in rated drywall systems.

1.4 SUBMITTALS

A. Submit manufacturer's product data describing all materials.

B. Submit gypsum board finish schedule indicating level of finish proposed per each area. Finish levels shall be levels 1 through 4 as specified herein and defined by "Recommended Specification: Levels of Gypsum Board Finish" as jointly published by AWCI, CISA, GA, and PDCA. Submit copy of publication with finish schedule.

C. Submit manufacturers detail drawings and detailed installation methods for fire rated penetrations and filling of voids with specified firestopping system. Submit only those systems applicable to this project.

D. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

B. Warranted defects shall include but not necessarily be limited to cracking, joint tape delamination or tearing, dimpling at fastener heads, bowing or warping of wall board, cracking at metal accessories, acoustical sealant failure.

1.6 DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered in manufacturer's original packaging and stored flat in a covered, dry area providing protection from damage and exposure to the elements.

B. Damaged or deteriorated materials shall be removed from the premises.

C. During cold weather installation of gypsum panels and joint finishing, temperatures within the building shall be maintained within the range of 50 degrees to 80 degrees F. Adequate ventilation shall be provided to carry off excess moisture.

D. Steel framing and related accessories shall be stored and handled in accordance with AISI's "Code of Standard Practice"

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Drywall Framing:
1. ClarkDietrich Building Systems

B. Gypsum Board and Related Accessories:
1. United States Gypsum Co.
2. National Gypsum Co.
3. Georgia Pacific
4. Temple Inland
5. James Hardie

C. Acoustical Batts:
1. Owens-Corning
2. Certaineed
3. Manville

D. Acoustical Sealant:
1. TREMCO
2. Ohio Sealants, Inc.

E. Specialty Trims:
1. Fry Reglet Corp.
2. MM Systems Corp.

F. Corner Guards:
1. WallProtex, (877) 880-8115

2.2 FRAMING: Comply with ASTM C645-09 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C645-09 requirements for metal unless otherwise indicated.

2. Protective coating: Comply with ASTM C645-09; roll formed from hot dipped galvanized steel; complying with ASTM A1003/A1003M and ASTM A653/A653M G40 (Z120) or having a coating that provides equivalent corrosion resistance. A40 galvannealed products are not acceptable.

A. METAL STUDS: 25 gauge (22 gauge where shown on drawings) galvanized roll formed, screw channel type studs with minimum 5/16 inch flanges and 1-1/4 inch legs. Provide widths of 1-5/8 inch, 2-1/2 inch, 3-5/8 inch, 4 inches and 6 inches as indicated in the drawings. Provide conduit punchouts at 24" o.c.

1. "EQ" (Equivalent Gauge Thickness) Steel Studs and Runners: Members that can show certified third party testing with gypsum board in accordance with ICC ES AC86-2010 (approved February 2010 Effective March 1, 2010) need not meet the minimum thickness limitation or minimum section properties set forth in ASTM C645-09.
2. Non-structural Studs: Cold-formed galvanized steel C-studs, ClarkDietrich Building Systems Pro STUD drywall studs as per ASTM C645-09 for conditions indicated below:
    a. Flange Size: 1 1/4 inch (32mm)
    b. Web Depth: As specified on drawings, 1-5/8 inches (41 mm) 2-1/2 inches (64 mm) 3-5/8 inches (92 mm) 4 inches (102 mm) 6 inches (152 mm).
    c. Member Description: ProSTUD 25 (25ga equivalent drywall stud) 70ksi Minimum Thickness: 0.0150 inches (0.3810mm) Minimum Design Thickness: 0.0158 inches (0.4013mm)
    d. Member Description: ProSTUD 22 (22ga equivalent drywall stud) 70ksi Minimum Thickness: 0.0179 inches (0.4547mm) Minimum Design Thickness: 0.0188 inches (0.4775mm)

B. RUNNER CHANNELS: Provide 25 gauge (22 gauge where shown on drawings) galvanized channels with minimum 1-1/4 inch flanges with hemmed edges, in widths to accommodate stud sizes.

1. Non structural Track: Cold-Formed galvanized steel runner tracks, ClarkDietrick Building Systems ProTRAK drywall track in conformance with ASTM C645-09 for conditions indicated below:
    a. Flange Size: 1 1/4 inch (32mm)
    b. Web Depth: Track web to match stud web size.
    c. Minimum Material Thickness: Track thickness to match wall stud thickness or as per design.

C. FURRING CHANNELS: Provide 20 gauge galvanized "hat" channels with face width of 1-1/4 inches, depth of 7/8 inches, and back Width of 2-9/16 inches minimum, hemmed edges.

D. CEILING SUSPENSION: Provide 16 gauge galvanized channels, 3/4" x 1/2" and 11/2" or 2" x 17/32".

1. Firestop tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
    a. Basis of Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; MaxTrak or an equivalent product.

2.3 ACCESSORIES

A. CORNER BEADS: 26 gauge galvanized beaded angle with 1-1/4" legs.

B. EDGE TRIM: 26 gauge galvanized steel "J" mould and angle with continuous bead. ClarkDietrich Building Systems 200.A and 200.B.

1. Channel Bridging and Bracing: Steel, 0.0538-inch (1.37mm) minimum base metal thickness, with minimum 1/2 inch (13mm) wide flanges.
   a. Basis of Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Spazzer 9200 Bridging and Spacing Bar, or an equivalent product.
   b. Depth: As indicated on drawings, 7/8 inch by 7/8 inch by 50 inches.

2. Backing Plate: Proprietary fire-resistance treated blocking and bracing in width indicated.
   a. Basis of Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Danback Fire-treated wood backing plate or an equivalent product.

C. WIRE: 9 gauge galvanized hanger wire and 16 gauge galvanized be wire.

D. SCREWS: Bugel head Type "S" self tapping drywall screws in lengths recommended by wallboard manufacturer. USG "Super-Tite".

E. CONTROL JOINTS: Roll formed zinc with 1/4" open joint, and perforated flanges. Provide with fireseal backing at rated systems. ClarkDietrich Building Systems No. 093.

F. JOINT ADHESIVE: Premixed water based compound. USG taping joint compound.

G. LAMINATING ADHESIVE: Durabond sheetrock setting-type for double-layer application and column fireproofing.

H. JOINT REINFORCING: Center creased paper tape equal to "Perf-A-Tape".

I. TROWELED FIRESTOPPING
1. System Type: A combination of glass fiber or mineral wool insulation packing material with troweled-on application of sealing compound.
2. Sealing Compound: Red tinted compound job mixed with water providing protection from heat (to temperatures of 1850 degrees F), smoke, toxic gas, fire and water. "Sta-Smooth FS 90 Fire-Shield Compound Fire and Smoke Stop" as manufactured by National Gypsum Co. or approved equivalent by Domtar Gypsum, Inc.
3. Approvals:
   a. Rated as noncombustible as defined by NFPA Standard 220 when tested in accordance with ASTM E 136 at Underwriters Laboratories.
   b. Meet all requirements of ASTM E 814 and UL 1479: Fire tests of through penetration fire stops.

J. CORNER GUARDS: Textured Vinyl Corner Guards 3” by WallProtex. 4’ lengths, taped. Color as selected by Architect.

2.4 WALLBOARD

A. TYPICAL: 5/8" thick x 48" wide paper-faced gypsum panels, tapered long edges, lengths as required. U.L. listed and conforming to ASTM C-1396/C1396M-09a Standard Specification for Gypsum Board, Type X. USG fire code.

B. WATER RESISTANT: 5/8" thick x 48" wide U.L. listed, Type X board with chemically treated face paper and water resistant gypsum core. Comply with ASTM C-1396/C1396M-09a Standard Specification for Gypsum Board.

C. HIGH IMPACT: 5/8” thick x 48” wide, length as required. U.L. listed, “Fiberock Interior Panel Abuse Resistant” by USG or equal.

2.5 TILE BACKER BOARD

A. 5/8" thick cement board formed of aggregated Portland cement slurry with polymer-coated, glass-fiber mesh. "Durock” as manufactured by United States Gypsum Co or approved equivalent.

PART 3 - EXECUTION

3.1 PARTITION INSTALLATION

A. STUD SYSTEM ERECTION: Attach metal runners at floor and to structural elements with suitable fasteners spaced maximum 24" o.c. Position studs vertically, engaging floor track and runner at ceiling or structure. Place studs in direct contact with all door frame jambs, abutting partitions, partition corners and existing construction elements.

B. Anchor all studs adjacent to door and window frames, partition intersections, and corners to ceiling and floor runner flanges. Securely anchor studs to jamb and head anchor clips of door or side-light frames by screw attachment. Over door and side-light frames, install horizontal runner with a web-flange bend at each end, and secure with one positive attachment per flange.

C. Install diagonal stud bracing above ceiling at strike side of door jambs and at other locations as indicated in the drawings. Secure to structure.

D. Follow stud manufacturer's recommendations for all framing construction and fastening.

3.2 WALL PANEL ERECTION

A. Apply gypsum panels vertically or horizontally. Position all edges over studs for vertical application; all ends over studs for horizontal application. Use maximum practical lengths to eliminate end joints. Fit ends and edges closely together. Stagger joints on opposite side of partition.

B. For single-layer vertical application of gypsum panels, space screws 12" o.c. in field of panels and 8" o.c. staggered along vertical abutting edges. For horizontal panel application, space screws 12" o.c. in field and along abutting end joints.

C. For double-layer screw attachment, space screws 16" o.c. for both layers. Apply both layers of gypsum panels vertically with joints in face layer offset from base layer joints. For 5/8" panels, use 1 " screws for base layer and 1-5/8" screws for face layers. For 1/2" panels, use 7/8" screws for base layer and 1-5/16" screws for face layer.

3.3 CHASE WALL ERECTION

A. Align two parallel rows of floor and ceiling runners spaced as indicated in the drawings. Attach to concrete slabs with powder actuated anchors 24" o.c. and to suspended ceiling tees or structure with suitable fasteners 24" o.c.

B. Position metal studs vertically in runners, 16" o.c., with flanges in the same direction and with studs on opposite sides of chase directly across from each other. Anchor all studs to floor and ceiling runner flanges with U.S.G. Metal Lock Fastener tool.

C. Cut gypsum panel bracing to be placed between rows of studs, 12" high by chase wall width. Space braces 48" o.c. vertically and attach to stud webs with screw fasteners. 2-1/2" metal studs may be used in lieu of gypsum panels. Anchor web at each end of metal brace to stud web with two 3/8" pan head screws.

3.4 CEILING FRAMING

A. GRILLAGE ERECTION: Space 8 gauge hanger wires 48" o.c. along carrying channels and within 6" of ends of carrying-channel runs. Wrap hanger around and through beams or joists. Install 1-1/2" carrying channels at 24" o.c. Position channels for proper ceiling height, level and secure with hanger wire saddle-bed along channel. Provide 1" clearance between runners and abutting walls and partitions. Secure furring to carrying channels with clips or saddle-tie to support. Overlap splices at least 8" and securely wire-fie each end with double-strand 16 gauge tie wire.

B. Erect metal furring channels at right angles to 1-1/2" carrying channels or main support members Space furring (16”) o.c. and within 6"of walls. Provide l" clearance between furring ends and abutting walls and partitions. Secure furring to carrying channels with clips or saddle-tie to supports with double strand 16 gauge be wire. Overlap splices at least 8" and securely wire-tie each end with double-strand 16 gauge fie wire.

C. At light troffers or any openings that interrupt the carrying or furring channels, install additional cross reinforcing to restore lateral stability of grillage.

D. At rated ceilings meet all requirements of selected U.L. Design No.

E. METAL STUD CEILING FRAMING OPTION: Attach runners at ceiling height through gypsum panels to each partition stud with two screws. Insert metal studs in runners and attach each end with one 3/8" pan head screw. Install 1-5/8" stud cross-bracing over stud framing, space 48" o.c. and attach to each framing stud with two 3/8" pan head screws. At hangers, install 12" long stud section for box reinforcing or lap studs 12" and secure each end with two 3/8" pan head screws. At light troffers or any openings that interrupt the ceiling, install additional cross reinforcing to maintain structural integrity of framing.

F. GYPSUM PANEL ERECTION: Apply gypsum panels of maximum practical length with long dimension at right angles to furring channels. Position end joints over channel web and stagger in adjacent rows. Fit ends and edges closely. Fasten panels to channels with 1 ", Type S screws, spaced 8" o.c. in field of panels and 8" along ends and edges.

3.5 EXTERIOR WALLS: Reference Section 05 41 00.

3.6 ACOUSTICAL BATTS

A. Install unfaced full thickness acoustical fiberglass batts between studs at partitions as scheduled on the drawings. Fit batts tight to studs, tight to floor and head tracks and tight to one another. Batts shall run full height of partition unless indicated otherwise in the drawings.

3.7 ACOUSTICAL SEALANT

A. Install continuous bead of sealant at bottom tracks at drywall partitions.

B. Install vinyl foam double stick tape and sealant where head track terminates at ceiling.

C. See drawings for additional locations.

3.8 ACCESSORY APPLICATION

A. JOINT SYSTEM: Finish all face panel joints and corners with U.S.G. Joint System installed according to manufacturer's directions.
   1. Mix joint cement in strict accordance with manufacturers directions.
   2. Butter cement into joints filling them evenly and fully.
   3. Center tape and press down into cement leaving sufficient cement under tape for proper bond. Cover with thin coat of cement to fill recess between tape and board to bring material flush with surface.
   4. Face panels shall be cut fit around all wall outlets and switch boxes, utility lines, etc. All voids and cracks, occurring around all openings in board shall be taped and covered with joint cement.

B. LAMINATING ADHESIVE: Spread to provide 1/2" adhesive beads 4-1/2" o.c. for full sheet lamination. For strip lamination, apply adhesive in vertical strips of four 1/2" beads, 1-1/2" to 2" o.c. Space strips 24" o.c.

C. CORNER BEAD: Reinforce all vertical and horizontal exterior corners with corner bead fastened with 9/16" rosin-coated staples 9" o.c. on both flanges along entire length of bead.

D. METAL TRIM: At exposed edges of board or where board terminates against other materials, apply metal trim over panel edge and fasten with screws.

E. SCREWS: Power-drive at least 3/8" from edges or ends of panel to provide uniform dimple of 1/32" deep.

F. CONTROL JOINTS: Cut panel at joint and back with double framing members. Attach control joint to face layer with 9/16" rosin-coated staples spaced 6" o.c. on both flanges along entire length of joint. At rated walls, provide fireseal behind joint. Provide joints at 25' maximum or as otherwise indicated in the drawings.

G. CORNER GUARDS: Install as per manufacturer’s recommendations. Double sided adhesive tape factory applied to corner guard.

3.9 TROWELED FIRESTOPPING:

A. General: Install systems in complete accordance with manufacturers printed instructions and approved submittal for the required fire rating of the particular condition. Install firestopping systems at all penetrations and voids in all rated drywall ceilings and walls.

B. Through-penetrations. Ensure that pipe, conduit, duct, cables or other penetration element is rigidly supported by drywall framing on both sides of wall or ceiling assembly. Oversize opening in wall board to allow for required opening size and thickness of packing material in accordance with system and rating requirements. Install packing material in accordance with system requirements and compressed to allow for required thickness of sealing material. Trowel red-tint sealing material into void (same thickness as

gypsum board) and smooth flush with both faces of drywall. Provide additional layer(s) of gypsum board around penetration where necessary to achieve required minimum thickness of sealing material.

C. Void-filling: For voids such as intersection of walls and smooth or corrugated deck, pack void with compressed packing material and trowel red-tint sealing material into void (same thickness as gypsum board) and smooth flush with both faces of drywall. Provide additional layer(s) of gypsum board around penetration where necessary to achieve required minimum thickness of sealing material.

3.10 WOOD BLOCKING: Coordinate with project carpenter to ensure installation of fire retardant wood blocking between studs for mounting casework, millwork, toilet partitions, drinking fountains and other equipment.

3.11 FINISHING SCHEDULE: Follow published "Recommended Specification: Levels of Gypsum Board Finish" as follows:

A. LEVEL 1 FINISH: At concealed areas above ceiling.

B. LEVEL 2 FINISH: At gypsum backing board to be covered with file or panels thicker than 1/4".

C. LEVEL 3 FINISH: At mechanical rooms, storage rooms, custodial and maintenance rooms, electrical and telephone closets.

D. LEVEL 4 FINISH: All other drywall areas scheduled for paint, fabric or vinyl wall covering.

END SECTION

SECTION 09 30 00 — WALL AND FLOOR TILE

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide and install all ceramic wall and floor tile and base as indicated in the drawings and specified herein.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Cast-in-place concrete.

B. Drywall systems.

C. Masonry.

D. Waterproofing and dampproofing.

1.4 SUBMITTALS

A. Per SUPPLEMENTARY GENERAL CONDITIONS, submit samples, type of tile and color for Architect’s approval. Mark with manufacturer’s name and space where tile is to be installed.

B. Submit manufacturer’s printed literature describing products.

C. Submit (2) boxes of tile chips showing full range of available colors.

D. Submit (2) boxes of grout color samples.

E. Submit 12” x 12” grouted sample board for each tile/grout combination selected.

F. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

B. Warranted defects shall include but not necessarily be limited to cracking, crazing, staining, joint spalling or cracking, loosening of bond.

1.6 QUALITY ASSURANCE

A. Tile Contractor shall have a minimum of 3 years experience in tile installation for projects of similar size and scope as this project.

B. Conform with all applicable requirements of the American Standards Association Specifications (A-108 Series) and the "Tile Handbook" of the Tile Council of America. Tile shall bear the seal of Tile Council of America, Inc., and be equal to or exceed Standard Grade.

1.7 DELIVERY & STORAGE

A. Deliver all manufactured materials in original, unbroken containers bearing name of manufacturer, brand and grade seal. Keep materials dry, clean and protected against deterioration in any form and at room temperature.

B. Maintain room temperature between 70 and 80 degrees F. 24 hours prior, during and a minimum of 48 hours after installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. CERAMIC TILE:
1. American Olean
2. Dal-Tile
3. United States Ceramic Tile Co.

B. GROUT:
1. American Olean
2. Laticrete
3. Tex Rite

2.2 MATERIALS

A. RESTROOMS:
1. Floor Tile: Unglazed porcelain ceramic with cushioned edges and sheet backing.
   a. Water absorption: Classified "Impervious" per A.S.T.M. C-373. Less than 1/2 of 1% absorption.
   b. Size: Nominal 1" x 1" x 1/4" thick.
   c. Base: 4" high base. Bottom tile with integral cove.
   d. Type: Porcelain Tile in ***group 3*** as selected by the Architect from one of the specified manufacturers.

e. Color(s): Bidders shall assume a different color scheme for each room unless colors and patterns are indicated in the drawings.

2. Wall Tile: Glazed ceramic with cushion edges.
   a. Size: Nominal 4” x 4” x 1/4" thick.
   b. Base: See floor base.
   c. Type: ***Group 1*** for field tile and for accent banding as selected by the Architect from one of the specified manufacturers.
   d. Color(s): Bidders shall assume a different color scheme for each room unless colors and patterns are indicated in the drawings.

3. Trim: Terminate tile with bullnose edges and rounded outside corners. Provide square inside corners and at ceiling/wall joints.

B. THINSET BOND COAT: Latex/Portland Cement mortar mix meeting requirements of ANSI A118.4. Provide Portland cement and sand in a 1 to 1 mixture gauged with Laticrete 4237 latex additive. Use on dry cured mortar bed at slab recesses, where thinset on concrete slab, and where thinset on wall substrates.

C. SEALANT: One part silicone rubber meeting requirements of FS TT-S-001543, as manufactured by Dow Corning or General Electric.

D. GROUT:
1. Walls: Portland Cement waterproof, dry set grout as manufactured by American Olean. Color(s) as selected by Architect.
2. Floor and base: Interior grout shall be epoxy type as manufactured by American Olean. Color(s) as selected by Architect.

E. SEALANT: One part silicone rubber meeting requirements of FS TT-S-001543, as manufactured by Dow Corning or General Electric.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Examine surfaces to receive tile and do not start work until defects that will adversely affect tile work have been corrected.

B. Inspect all surfaces to see that they are dry, clean, free of oily or waxy film, firm, level and plumb. Report any unsatisfactory conditions to the Architect. Starting installation shall be deemed as acceptance of surfaces.

C. Do not start until work of other trades, which goes through or in the space behind tile has been completed. Do not proceed with installation until adjoining work is satisfactory protected. Close off spaces in which tile is being set to traffic and other work during installation and for at least 48 hours after completion of tile work.

D. Do not apply mortar and adhesives to surfaces covered by frost. Maintain minimum temperature-for installation of tile above 50 Deg. F. Prevent rapid evaporation of moisture from mortar bed. Do not set tile on dry bed.

E. Install specified mortar bed at slab depressions. Slope mortar bed uniformly to drain(s).

3.2 INSTALLATION

A. GENERAL: Tile shall be installed in accordance with current Tile Council of America's "Handbook for Ceramic Tile Installation", design numbers as indicated below.

B. Center fields and patterns on applied areas so that no tile is less than half size. For heights stated in feet and inches, maintain full courses to nearest attainable height without cutting tile.

C. Except where otherwise shown or specified, make joints in wall tile vertical and horizontal and joints in floor tile perpendicular and parallel to walls. Control joint widths of glazed tile by lugs on the sides of tile. Control joints widths between sheets of ceramic mosaic tile by supporting boards with metal spacing strips.

D. Grind and fit tile carefully at intersections, against trim finish and at built-in fixtures and accessories. Fit tile closely around outlets, pipes, fixtures and fittings so that plates, escutcheons and collars will overlap cuts. Cut and drill tile and trim shapes accurately without damage. Rub all exposed cut edges smooth with abrasive stone.

E. Coat trim with 1/32 to 1/16" pure coat paste. Set in same mortar mix as is recommended for setting flat tile on walls. Do not use pure coat as mortar to set trim and angles.

F. FLOORS:
1. Interior thinset on concrete floor slab:
   a. Tile bonded with minimum 3/32" thick latex-Portland cement bond coat over cleavage membrane adhered to floor slab **(modified TCA F113).**
   b. Adhere cleavage membrane to slabin strict accordance with manufacturer's recommendations using specified latex-Portland cement bond coat. Increase typical curing time of bond coat by 50%.
2. Interior thin-set on recessed mortar bed (where required at existing kitchens): Tile bonded with minimum 3/32" thick Latex-Portland Cement bond coat to reinforced mortar bed over loose bond breaker membrane over floor slab **(TCA F111).**

G. WALLS:
1. Ceramic Tile at Drywall Toilets: Thinset to water resistant gypsum wallboard.
2. Ceramic Tile at Drywall Showers: Thinset to tile backer board.
3. Ceramic Tile at Masonry: Bonded to mortar bed at masonry. No. **W211**.
4. 12" x 12" Porcelain – Up to 3 ft. High Wainscot: Install with mastic over drywall.
5. 12" x 12" Porcelain – Over 3 ft. High Wainscot: Thinset over tile backer board.

H. EXPANSION JOINTS:
1. At floor tile provide 1/4" sealant expansion joints in accordance with TCA recommendations where tile abuts walls, curbs, columns and other restraining surfaces, where substrate material changes, at floor slab construction joints (cold joints), and each way in pattern approved by the Owner.
2. At walls install sealant expansion joints at inside corners, at maximum 30', and at other conditions subject to cracking or movement. Install specified sealant at expansion and control joints, at doorframe perimeters and similar conditions.

3.3 LAYOUT

A. Layout all work so that no tiles less than half size occur. Align all joints vertically and horizontally.

B. Cut and drill neatly without marring tile. Rub smooth any necessary cuts with a fine stone and set no cut edge against any fixture, cabinet, or other tile without a joint at least 1/16" wide.

C. Maximum plane variation shall be 1/8" + or – in 10' when a straight edge is laid on the surface in any direction.

3.4 GROUTING AND SEALING:

A. Follow grout manufacturer's recommendations for grouting procedures and precautions. Damp cure non-epoxy grout in accordance with manufacturer's recommendations.

B. Grout Haze Removal:
1. Unglazed Tile: For cement grout remove all grout haze following grout manufacturer's recommendations for use of acid and chemical cleaners. Rinse tilework thoroughly with clean water before and after chemical cleaners. Polish surface of tilework with soft cheesecloth.
2. Glazed Tile: For cement grout remove all grout haze with cheesecloth rub.
3. Take special care with epoxy grout to keep tiles clean as work progresses.

3.5 PROTECTION

A. Protect tiled floors from foot and wheel traffic for at least 7 days after installation.

B. Place plywood panels over traffic floors.

C. In non-traffic areas, cover floors with heavy paper taped in place.

D. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Furnish quantity not less than 5 percent for each color, pattern, and type of tile installed.

END OF SECTION

SECTION 09 51 00 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide and install all lay-in acoustical ceiling panels and suspended grid system in accordance with the drawings and as specified herein.

B. Provide and install light fixture protection at all rated ceilings.

C. Provide and install hold-down clips where required for rated system.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Mechanical (air devices)

B. Electrical (lighting fixtures)

1.4 DRAWING REFERENCES

A. See drawings, finish schedule and Section 2.2 for ceiling types and ratings.

1.5 SUBMITTALS

A. Submit manufacturer's product data describing all materials, finishes, ratings and installation requirements.

B. Submit physical samples for each type of acoustical file proposed.

C. Submit physical samples for each type of grid proposed.

D. Submit tile manufacturer's certification for whether hold-down clips are required for the selected tile(s) and rated system(s).

E. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.6 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

B. Warranted defects shall include but not necessarily be limited to rusting or deflection of grid, deterioration or deflection of acoustical tiles.

1.7 QUALITY ASSURANCE

A. Suspended acoustical ceiling contractor shall have a minimum of 3 years experience in the installation of specified systems for projects of similar size and scope of this project.

B. Installation of acoustical tile and panels shall not begin until residual moisture from plaster, drywall, concrete or terrazzo work is dissipated. Before installation, the building shall be enclosed and permanent heating and cooling equipment in operation.

1.8 DELIVERY AND STORAGE OF MATERIALS

A. Do not deliver materials to jobsite until spaces are ready for ceiling installation.

B. All materials shall be delivered in manufacturer's original packaging and stored in an enclosed shelter providing protection from damage and exposure to the elements.

C. Damaged, rusted or deteriorated materials shall be removed from the premises.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. TYPICAL CEILING PANELS:
1. Armstrong World Industries, Inc.
2. USG Interiors, Inc.

B. GRID SYSTEMS:
1. Armstrong World Industries, Inc.
2. USG Interiors, Inc.
3. Chicago Metallic Corp.

2.2 MATERIALS:

A. TYPICAL CEILING PANELS:

1. 24" x 24" x 5/8" white **"Cortega Square Lay-in" No. 770**, square-edged as manufactured by Armstrong or equivalent (color, pattern, texture) by specified manufacturer. **Non-rated system.**

B. SUSPENSION SYSTEM:

1. Components shall be formed from commercial quality cold-rolled steel, electro-galvanized, 2' x 2' module.

2. The suspension system shall support the ceiling assembly with a maximum deflection of 1/360 of the span per A.S.T.M. C-635-69.

3. Main tee with double web design 1-1/2" high and rectangular bulb; 15/16" exposed flange with rolled cap; cross tee holes at 6" o.c.

4. Four foot cross tee 1-1/2" high with double web design. Rectangular bulb joining main runners at 2' on center.

5. Two foot cross tees perpendicular to 4' cross tees. Two foot cross tees minimum of 1-1/2" high, No. CMC 222-41 or equivalent by specified manufactured.

6. Wall molding - hemmed edge, electro-galvanized cold rolled steel with equal leg width, finish to match grid.

7. Finish: Typical finish, factory white painted steel. At high humidity areas including kitchens, dressing rooms, toilet rooms provide factory white painted aluminum cap.

8. Rating: Provide U.L. listed grid for scheduled system rating.

PART 3 – EXECUTION

3.1 COORDINATION

A. Verify that above ceiling work, including fire dampers, ductwork, piping, wiring and insulation is complete and approved prior to beginning ceiling work.

3.2 INSTALLATION

A. Ceiling systems shall be suspended from structural members by 12 gauge annealed wire; spacing as recommended by manufacturer. Provide additional support for light fixtures and grilles at each corner. Provide secondary support framing ("Unistrut") where spacing of structural members exceeds suspension system manufacturer's recommendations.

B. Acoustical lay-in panels shall be installed in strict accordance with the manufacturer's instructions. Tile shall be installed with fissures or pattern all in same direction.

C. Provide additional hangers at ceiling suspended items including projection screens, speakers, exit lights, air supply and return grilles.

D. Space main runner hangers a maximum of 6 inches from wall. Do not support systems from wall.

E. Adjust hangers to ensure level ceiling in plane.

3.3 RATED CEILINGS

A. Provide specified ceilings in fire rated assembly. Protect light fixture protection in accordance with approved U.L. Design to meet required assembly rating. Provide additional hangers to meet the requirements of the particular U.L. rating.

B. Ceiling system manufacturers not listed in the required U.L. design number (reference drawings) shall be responsible for determining whether their rated system is acceptable to the particular local code authority.

C. For ceiling tiles weighing 1 lb. per square foot or more, verify no requirement for hold-down clips at rated systems.

3.4 CLEANING AND REPLACEMENT

A. At completion, replace file unit and grid systems that are damaged. Clean or replace tile and grid systems that cannot be cleaned.

B. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Furnish quantity not less than 5 percent for each color, pattern, and type of ceiling tile installed.

END OF SECTION

SECTION 09 65 19 - RESILIENT FLOOR TILE

PART 1 – GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 SUMMARY

A. Section Includes:
   1. Luxury vinyl tile (LVT).

B. Related Sections:
   1. Section 09 65 13 "Resilient Wall Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   1. Show details of special patterns.

C. Samples for Initial Selection: For each type of floor tile indicated.

D. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.7 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.
B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
C. Close spaces to traffic during floor tile installation.
D. Close spaces to traffic for 48 hours after floor tile installation.
E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 – PRODUCTS

2.1 LUXURY VINYL TILE (LVT)

A. Products: Subject to compliance with requirements, provide the following:
   1. Interface (Basis of Design)

B. Tile Standard: ASTM 1700, Class III, Type A
C. Gauge: 0.10” (2.5mm)
D. Wear layer: 20 mil (0.5mm)
E. Size: The following sizes are basis of design. Variations to these shall be submitted for review and approval 10 calendar days PRIOR to bid date. To be considered as equal to basis of design, substitute products must approximate pattern and color line of the LVT specified above. Requests for substitutions that do not submit complete, straightforward, and referenced information for product comparison will be considered non-responsive and rejected without further notice. Basis of Design as follows:
   1. Winning Team Collection – Studio Set at Dorms, Multi-Use Rooms, Stage, Breakroom, & Hallways

F. Colors at Dorms, Multi-Use Rooms, Stage, Breakroom, & Hallways: Three color pattern. To be selected by the Architect.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.
   1. Adhesives shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      a. VCT and Asphalt Tile Adhesives: Not more than 50 g/L.
   2. LVT Adhesive shall be from manufacturer’s products as required and installed in accordance with manufacturer’s requirements.
C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
    a. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate. Floorstone as required to achieve working conditions.

D. Do not install floor tiles until they are same temperature as space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern) and in pattern of colors and sizes indicated.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

G. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply five coats.

E. Cover floor tile until Substantial Completion.

1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Furnish quantity not less than 5 percent for each color, pattern, and type of tile installed.

END OF SECTION

SECTION 09 68 00 – CARPET

PART 1 – GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 SUMMARY

A. Section Includes:
1. Carpet (broadloom).
2. 24x24 Carpet Tiles.
3. Accessories.

B. Related Documents: The Contract Documents, as defined in Section 01 11 00 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

C. Related Sections:
1. Section 09 65 00 - Resilient Flooring: Tile and base.
2. Section 14 20 00 - Elevator: Elevator Cab floor finish.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM E 684 - Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

B. BOCA:
1. FF-1-70.

C. Carpet and Rug Institute (CRI):
1. CRI 104 - Standard for Installation of Commercial Textile Floorcovering Materials.
2. Green label certification.

D. HUD:
1. UM44d Standards.

E. National Fire Protection Association (NFPA):
1. NFPA 253 - Test for Critical Radiant Flux of Floor Covering Systems.
2. NFPA 258 - Standard Research Test Method for Determining Smoke Generation of Solid Materials.

1.4 SYSTEM DESCRIPTION

A. Recycled content: minimum 50% total recycled content, with not less than 10% post consumer recycled materials and the balance post-industrial recycled materials.

B. Materials: all materials shall be high quality and of the type generally accepted for use in the industry. When used as intended, the materials shall be non-toxic, non-allergenic and free of similar health hazards. These materials include, but are not limited to, adhesives, cleaners, solvents, etc.

C. Recyclability: The carpet must be 100% recyclable.

D. Carpet shall inhibit the growth of fungi, gram-positive and gram-negative bacteria, in accordance with AATCC 138 or AATCC 174, parts 2 and 3. (Provide 3000 ppm of zinc OMADINE® bactericidefungicide.)

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Procedures for submittals.

1. Product Data: Data on specified products, describing physical characteristics and method of installation.
2. Shop Drawings: Indicate seaming plan, method of joining seams, and direction of carpet.
3. Samples: Submit two samples 13-1/2 inch x 18 inch in size illustrating color and texture.

B. Procedures for Closeout Submittals:

1. Include the following certifications:
    a. Stain proof certificate.
    b. No zippering certificate.
    c. Carpet and Rug Institute green label certification.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing work of this Section with minimum 5 years documented experience.

B. Regulatory Requirements:

1. NFPA 253 Critical Radiant Flux in Accordance with ASTM E 684: Class 1.
2. NFPA 258 NBS Smoke Chamber: Less than 450 flaming mode.
3. BCA flame spread classification: DOC FF-1(use group R-2 sprinklered).
3. HUD: UM44d Standards.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Adhesives: No adhesives to be used.

B. CRI “green label”.

1.8 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Transport, handle, store, and protect products.

B. Deliver carpet in original mill wrappings with register number marked on each bale.

C. Storage areas shall be secure and dry with temperatures maintained above 65 degrees F at all times.

D. Remove carpet from its packaging and allow to acclimatize to area of installation 24 hours before application.

1.9 PROJECT CONDITIONS OR SITE CONDITIONS

A. Environmental Requirements: Do not install carpet unless a constant temperature of at least 65 degrees F. is maintained for 72 hours before, during and 48 hours after application in all areas to receive carpeting.

1.10 WARRANTY

A. Carpet Manufacturer's Warranty:

Submit a written Warranty, signed by carpet manufacturer and carpet installer agreeing to repair or replace carpet that does not meet requirements or that fails in materials or workmanship, including but not limited to the following:

A. Delamination.
B. Edge ravel.
C. Wear.
D. Tuft bind.

2. Warranty Period: 10 years.

1.11 MAINTENANCE

A. Maintenance Data: Maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with Project requirements, manufacturers offering Products which may be incorporated in the Work include the following:

CARPET TILES AND CARPET:

1. Interface, LaGrange, GA. 800-336-0225

2.2 CARPET ACCESSORIES

A. Subfloor Filler: Latex underlayment, mixed with undiluted latex liquid furnished by the selected manufacturer. Use one of the following products.

1. Levelayer I, by Dayton Superior Corporation, Miamisburg, OH (800) 745-3700.

2. No. 345, by W.W. Henry Company, Orange, CA (800) 447-0216.

3. Approved Substitutions: Refer to Section 01 25 00 – Products and Substitutions.

B. Tackless Strip: Carpet gripper, of type recommended by carpet manufacturer to suit application, with attachment devices.

C. Base Gripper: Tackless strip type with special lipped edge; color to match carpet.

D. Seam Adhesive: Recommended by manufacturer.

E. Rubber Transition and termination strips: Equal to Johnsonite Specialty Flooring Accessories, color to be selected by Architect

F. Adhesives: Materials must comply with the toxicity and emission limits specified in Article 1.3 above.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution Requirements: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to Architect prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.2 PREPARATION

A. Prepare substrate for product installation in accordance with manufacturer's published instructions.

B. Subfloor ridges, bumps, and other irregularities. Fill cracks, contraction joints, holes, and depressions with subfloor filler as recommended by manufacturer to achieve smooth, flat hard surface.

C. Where carpet is installed on existing wood floors, carpet shall be installed directly on existing floors without underlayment.

D. If carpet is installed on concrete floors, apply subfloor filler and leveler to provide finished concrete surface smooth, with no more than 1/8 inch variation from plane within 10 feet in any direction. Prohibit traffic until subfloor filler is cured.

E. Remove old adhesive, paint, oils, waxes, sealers and curing compounds not compatible with adhesive to be used. Avoid organic solvents.

F. Vacuum clean substrate.

3.3 INSTALLATION

A. General Installation:

1. Install carpet and cushion in accordance with manufacturers instruction and CRI 104.

2. Verify carpet match before cutting to ensure minimal variation between dye lots.

3. Lay out carpet.

   A. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
   B. Do not locate seams perpendicular through door openings.
   C. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
   D. Locate change of color or pattern between rooms under door centerline.
   E. Provide monolithic color, pattern, and texture match within any one area.
   F. Extend carpet under removable flanges and furnishings and into alcoves and closets of each space.
   G. Provide cut outs where required and bind cut edges where not concealed by protective edge guards or overlapping flanges.
   H. Install with pattern parallel to walls and borders.

4. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance. Use power stretcher where carpet is greater in length than 20 feet.

5. Install carpet edge guard where edge of carpet is exposed and anchor guards.

6. Install carpet by trimming edges, butting cuts with seaming cement, and taping and/or sewing seams to provide sufficient strength for stretching and continued stresses during life of carpet.

7. Trim edges and butt cuts with seam cement.

8. Carpet shall be installed directly on floor slab or wood floor with reusable hook/loop tape method using 3M TacFast or approved equal. Double sided tape is not acceptable.

B. Installation on Interior Steel Stairs:

1. Install tackless strips at back of treads, with pins facing riser, and at bottom of riser, with pins facing tread.

2. Install cushion on stair treads and lap over nosing.

3. Install carpet on stairs with the run of the pile in opposite direction of anticipated traffic to avoid peaking of backing at nosings.

4. Stretch carpet over stair treads, full width in one piece as indicated on plans. Fold carpet under 1 1/2 inches (4 cm) on each side.

3.4 FIELD QUALITY CONTROL

A. Section 01 45 00 - Quality Control: Field inspection.

B. Inspect carpet and base installation, seaming, pattern, layout, and attachment to substrate.

3.5 CLEANING AND PROTECTION

A. Comply with CRI 104, Section 15 - Protection of Indoor Installation, and manufacturer’s recommended cleaning procedures and as follows.

B. Section 01 70 00 - Execution Requirements: Cleaning and protection of installed work.

C. Vacuum carpet using commercial machine with face-beater element. Remove spots, according to manufacturer's recommendations, and replace carpet where spots cannot be removed. Remove any protruding face yarn using sharp scissors. Final cleaning with HEPA vacuum as required by Section 01 35 00.

D. Remove and recycle excess material as required by the Construction Waste Management Program, Section 01 56 50.

3.6 SITE ENVIRONMENTAL PROCEDURES

A. Indoor Air Quality:

1. Temporary ventilation: As specified in Section 01 15 00 - Environmental Procedures.

A. Ventilate products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues. Provide a temperature range of minimum 60 degrees F to maximum 90 degree F continuously for minimum 72 hours. Do not ventilate within limits of Work unless otherwise approved by Owner and Architect.

3.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Furnish quantity not less than 5 percent for each color, pattern, and type of carpet installed.

END OF SECTION

SECTION 09 91 00 – PAINTING AND FINISHING

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide all labor, materials, and equipment required for all painting, staining and finishing as indicated in the drawings, the approved submittals, and as specified herein. Painted or stained systems include but are not necessarily limited to the items listed below:

B. EXTERIOR SYSTEMS:

1. All visible wood unless noted otherwise.
2. All ferrous metal. All galvanized metal unless noted otherwise. Touch-up on welds or damaged finishes.
3. Exposed conduit, piping, etc., except for roof mounted piping not visible.
4. Exposed roof mounted equipment visible from ground level or from upper floors of the building.
5. All exposed concrete masonry units.
6. All items normally painted in accordance with good construction practice.

C. INTERIOR SYSTEMS:

1. All visible wood or behind cabinet doors unless noted otherwise.
2. All ferrous metal. All galvanized metal unless noted otherwise. Touch-up on welds or damaged finishes. Structural steel, steel joists and deck exposed to view except in mechanical rooms.
3. Exposed conduit, piping, outlet boxes, raceways, and panel boxes except galvanized or aluminum piping located in mechanical or electrical rooms.
4. All exposed concrete masonry units, gypsum board and plaster unless otherwise noted.
5. All factory-primed hardware. Back-priming of all wood trim, millwork or finished carpentry prior to installation.
6. All hollow metal doors and frames.
7. All items normally painted in accordance with good construction practice.
8. All unfinished louvers and grilles.

1.3 WORK TYPICALLY EXCLUDED

A. Shop applied primer on structural steel and miscellaneous metals items.

B. Aluminum frames, doors, and windows.

C. Plastic clad casework, millwork, and wall panels.

D. Factory finished equipment unless noted otherwise (provide job touch-up).

1.4 DRAWING REFERENCE: Reference any paint or finish notes in the drawings for any pre-selected colors or other requirements.

1.5 SUBMITTALS

A. Submit manufacturer's product data describing each proposed type of paint, sealer, stain, or coating and it's recommended use. Include viscosity and percent solids information. Where not the specified base manufacturer, list the specified brand name and type and the proposed substitute. The Architect shall be the sole judge as to equivalency of systems.

B. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.6 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of two years after the date of Substantial Completion of the project.

B. Warranted defects shall include but not necessarily be limited to peeling, crazing, cracking, blistering, mildewing, chalking or dusting, pin holes, color fade or loss of hardness or sheen.

1.7 QUALITY ASSURANCE

A. Painting contractor shall have a minimum of 5 years experience in the application of the specified systems for projects of similar size and scope as this project.

B. If requested by the Architect, provide system manufacturer's certification of the proposed painting contractor as approved for application of the product.

1.8 DELIVERY, STORAGE AND HANDLING

A. Do not deliver painting materials to the jobsite until spaces and surfaces are ready for painting.

B. Deliver materials in manufacturer's original containers, unopened except for shop mixing of colors. Containers shall bear manufacturer's readable labels indicating brand and type of paint. Any additional containers with labels indicating products not approved shall be removed form the jobsite. Any applied material not previously approved by the Architect is subject to removal and reapplication with the appropriate approved product.

C. Store materials in environmentally controlled area. Interior products shall be acclimated to a temperature range of 50-80 degrees F. at least 24 hours prior to application.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. TYPICAL PAINTS: Systems are based on the first listed manufacturer. Only equivalent systems provided by specified manufacturers in accordance with attached Product Comparison sheet and as approved by the Architect are approved for use.

1. Sherwin Williams, Inc.
2. Pittsburgh Paints
3. Pratt & Lambert
4. Benjamin Moore Co.

B. SPECIALTY PAINTS:

1. Epoxies: Sherwin Williams, PPG, Pratt & Lambert.

C. SUBSTITUTIONS: In accordance with Section 01 25 00 Substitution Procedures.

2.2 INTERIOR SYSTEMS

A. SYSTEM TYPES FOR NEW WALLS (Unless indicated otherwise on Finish Schedule or drawings):

1. Drywall in toilet rooms, storage rooms, and mechanical/electrical/toilet rooms: **Semi Gloss Enamel** at walls and ceilings.
2. Drywall soffits: **Eggshell Enamel**.
3. Typical masonry (CMU): **Gloss Enamel.**

B. SYSTEM DESCRIPTIONS (Reference item 3.3 for modifications and preparation required for these systems when applied to existing walls already painted):

1. Primer on gypsum board: SW PrepRite High Build Primer B28W601 – one coat over light to medium texture (submit texture sample for approval)
2. Eggshell Enamel on Drywall: SW Pro Mar 400 Latex Eg-Shel B20W4400 – one coat over specified primer.
3. Semi-Gloss Enamel on Drywall: SW Pro Mar 400 Latex Semi Gloss B31W4400 - one coat over specified primer.
4. Epoxy Paint on Drywall: One coat SW PrepRite 200 Latex Primer B28W200 over specified primer.
5. Gloss Enamel on Drywall: Two coats SW Water Based Catalyzed Epoxy B70 Series gloss acrylic over specified primer.
6. Semi-Gloss Enamel on shop-primed metals: SW Water Based Industrial Enamel B53-300 acrylic gloss Enamel – two coats.
7. Natural Finish on Wood: SW Sherwood BAC Wiping Stain (one coat) + SW Wood Classics Sanding Sealer B26V3 (one coat) + SW Wood Classics Satin Varnish A66.
8. Clear Finish on Wood: SW Wood Classics Polyurethane Varnish A67 (two coats). Sand lightly between all coats.
9. Block Filler: SW Prep Rite Block Filler B25W25 (for areas not subject to moisture); SW Heavy Duty Block Filler (for areas subject to moisture). Provide 2 coats as specified under “Execution”.
10. Gloss Enamel on CMU or concrete: Two coats block filler plus two coats SW Water based Industrial Enamel gloss acrylic latex over specified primer.
11. Semi-Gloss Enamel on CMU or concrete: Two coats block filler plus two coats SW Water Based Industrial Enamel semi-gloss acrylic latex over specified primer.

12. Semi-Gloss Epoxy Paint on concrete: One coat SW Water Based Epoxy semi-gloss over cured concrete plus finish coat of SW Water Based Epoxy semi-gloss. Minimum paint thickness 3.0 dry mils.
13. Gloss Epoxy Paint on CMU: Two coats block filler (unless surface-bonded) plus finish coat of gloss. Minimum paint thickness 3.0 dry mils.
14. Gloss Epoxy Paint on concrete: One coat SW Water Based Epoxy gloss over cured concrete plus finish coat of SW Water Based Epoxy gloss. Minimum paint thickness 3.0 dry mils.
15. Semi-Gloss Enamel on utility piping and galvanized metals: SW Pro-Cryl Universal Metal Primer – one coat + SW DTM Acrylic Semi Gloss – two coats.
16. Semi-Gloss Epoxy Paint on CMU: Two coats block filler plus finish coat of SW Water Based Epoxy semi-gloss. Minimum paint thickness 3.0 dry mils.
17. Gloss Aliphatic Urethane Enamel on primed steel railings: Over epoxy shop primer apply two coats SW Hydrogloss Single Component Water Based Urethane B65-181 Urethane Gloss Enamel using airless spray equipment.
18. Dry Fall Acrylic (exposed deck, structure and rigging): One coat SW Super Save Lite Acrylic Dry Fall Eggshell Primer & Finish. Black color. Overspray dries to non-adhering dust in a ten foot fall.

2.3 EXTERIOR SYSTEMS

A. SYSTEM TYPES:

1. Exterior Metals: **Gloss Enamel.**
2. Field welds: **Zinc-Rich Coating.**

B. SYSTEM DESCRIPTION:

1. Gloss Enamel on Galvanized Metals: SW Pro-Cryl Universal Metal Primer B66W310 (one coat) + SW Sher-Cryl HPA B66-300 enamel – two coats.
2. Block Filler on CMU: SW Heavy Duty Block Filler B24W46, one coat.
3. Gloss Enamel on Shop-Primed Metals: SW Sher-Cryl HPA B66-300 gloss enamel-two coats.
4. Gloss Enamel on Aluminum: SW Pro-Cryl Universal Metal Primer B66W310 – (one coat) + SW Sher-Cryl HPA B66-300 gloss enamel – two coats.
5. Field Welds: "ZRC" cold-applied galvanizing.

PART 3 - EXECUTION

3.1 PREPARATION

A. METALS: Remove grease, oil, and dirt. Touch-up any damaged primer with like material. Remove any welding tags and grind smooth before painting. Fill any open galvanizing ports.

B. PLASTER, CMU, CONCRETE: Remove dusting and mortar residue. Remove any efflorescence and seal. Ensure that plaster, concrete and mortar joints are dry and fully cured.

3.2 APPLICATION

A. GENERAL: All paint and finishes be brushed or sprayed in even, uniform coats without runs or sags. Allow each coat to dry completely before applying succeeding coats. All surfaces shall be dry and no painting shall be done in damp conditions or when the ambient temperature is below 50 degrees F.

B. WOOD DOORS: Factory sealed tops, bottoms, and edges of plastic laminate surfaced doors left undisturbed require no additional finishing. Reseal any job cuts. Paint metal glazing stops.

C. MECHANICAL/ELECTRICAL EQUIPMENT: Painting contractor shall examine the mechanical and electrical drawings to determine quantities and locations of exposed piping, louvers not shown in Architectural drawings, electrical and telephone panels in finished areas, exposed electrical conduit in finished areas.

D. BLOCK FILLER AT CMU: Apply **first coat** of filler to ensure penetration into voids and work into block texture with bristle brush. Follow with a **minimum of one additional coat.** Provide uniform finish with no pinholes.

E. DRYWALL: Paint finish, sheen and texture shall be uniform and match the samples submitted to and approved by the Architect.

PART 4 – SCHEDULES

4.1 COLOR SELECTIONS

A. SCHEDULE: Unless colors are pre-selected in the Bidding Documents, the Architect shall prepare color schedule for the project using colors selected from the approved paint manufacturer(s). Where colors are pre-selected, the painting contractor shall use the colors selected or submit a schedule of proposed exact color matches by one of the specified paint manufacturers. **Provide 12” x 12” samples of actual paint for each color** whether pre-selected color or proposed color match.

B. DOCUMENTATION: Upon completion of the Project, painting contractor shall furnish to the Architect a complete schedule of paint brands, types, and colors actually used for each room and area.

4.2 EXTRA MATERIALS

F. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Furnish quantity not less than 5 percent for each color (field and accent) of paint used.

END OF SECTION

SECTION 10 11 23 – TACK BOARDS

PART 1 – GENERAL

1.00 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.01 SUMMARY

A. Perform all work required to complete the bulletin boards, and marker boards indicated by the Contract Documents and furnish all supplementary items necessary for its proper installation.

B. The requirements of Division 0 – “Bidding and Contract Requirements” and Division 1 – “General Requirements” of this Project Manual shall apply to all Work required for this Section.

1.02 SUBMITTALS

A. SAMPLES:
   1. Submit for approval samples of typical accessories showing construction and finish specified.

B. SHOP DRAWINGS:
   1. Submit manufacturer’s literature and mark sufficiently to indicate compliance with these specifications. Show locations, methods of supporting, methods of anchoring and finishes of each accessory.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Material manufacturer by any of the following manufacturers is acceptable, provided it complies with the Contract Documents.

   1. Claridge Products and Equipment, Inc.
   2. Newline

2.02 MATERIALS

A. TACKBOARDS: Fabri-cork tacking surface on 1/4” cork, 1/4” hardboard; overall 1/2” thick; wt. 2 1/2” lbs./sq. ft.; colors to be selected from manufacturer’s standard colors. Size: 4’ x 8’.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer’s instructions and approved shop drawings. Install accessories plumb, square, level and true with wall or surfaces.

B. Frames of recessed accessories shall neatly trim the opening. Gaps and voids between frames and finished walls will not be allowed. Exposed and concealed fasting shall match finish or fixtures and shall be stainless steel, theft proof type.

C. Install concealed anchor plates to wall construction for mounting. Provide grounds or rough bucks, where required, to rigidly secure accessories.

3.02 CLEANING

A. Remove all manufacturer’s temporary labels or marks of identification. Clean and polish to remove all oil, grease, and foreign material. Leave in a neat, orderly and clean condition acceptable to the Architect.

END OF SECTION

SECTION 10 14 00 — GRAPHICS AND SIGNAGE

PART 1 - GENERAL

1.1 COORDINATION:

A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Material and installation for the Plastic Room Identification Plaques.

B. Material and Installation for Exterior/Interior Building Identification Letters.

C. Material and Installation For Building Dedication Plaque with logos (including but not limited to conversion of architectural drawings into useable vector line art format).

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Interior wall materials and finishes.

B. Exterior wall materials and finishes.

C. Typical handicapped site signage.

1.4 SUBMITTALS

A. Submit manufacturer’s product data describing materials, and mounting methods for Room Identification Plaques, Exterior/Interior Building Identification Letters, and Building Dedication Plaque.

B. Submit color samples of actual material for color and finish selection by Architect.

C. Submit finished sample of room identification plaque(s) with any required symbols other than text.

D. Submit paper “rubbing” of final layout of Building Dedication Plaque for Architect’s approval.

E. Submit full size paper layout of Exterior Building Identification Letters for each line of text.

F. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

B. Warranted defects shall include but not necessarily be limited to color fading, delamination, failure of anchoring or fastening, cracking, breaking or tarnishing.

C. Exterior signage or building letters contributing to streaking or staining of building shall be a defect to be corrected by the Contractor, with building materials cleaned or replaced as required.

1.6 QUALITY ASSURANCE

A. Fabrication and installation company shall have a minimum of 3 years experience in the installation of similar systems for projects of similar size and scope.

1.7 DELIVERY, STORAGE AND HANDLING

A. Do not deliver materials to the jobsite until surfaces are ready for installation of graphics.

B. Store materials in covered, dry, temperature and humidity controlled space.

2 PART TWO – PRODUCTS

2.1 MANUFACTURERS

A. ROOM IDENTIFICATION PLAQUES:
   1. South Texas Graphic Specialties, Inc.
   2. The Southwell Co.
   3. Cantrell Industries.

B. EXTERIOR BUILDING IDENTIFICATION LETTERS:
   1. A.R.K. Ramos
   2. Gemini Inc.
   3. Matthews Bronze Div. – Architectural Products
   4. Metal Arts

C. BUILDING DEDICATION PLAQUE:
   1. A.R.K. Ramos
   2. Matthews Bronze Div. – Architectural Products
   3. Metal Arts
   4. OMC Industries, Inc.

2.2 MATERIALS

A. ROOM IDENTIFICATION PLAQUES:
   1. 6” X 9” X ¼” thick two tone series:
   2. Fabrication: Constructed of Wilson Art face laminate (as selected by the Architect from manufacturer’s standard selections) laminated to a solid acrylic core. The raised 1/32” acrylic copy shall be cut through the laminate face color and chemically welded to the acrylic core to assure permanent attachment, including the symbols. Any lower and secondary copy shall be 5/8” high Helvetica Medium (all caps) incised copy paint filled. Colors as selected by the Architect. Any secondary copy shall be 8-stroke computer engraved. Rounded corner letters will not be

acceptable. The edge of the signs shall be finished to match the face laminate color-to-color as selected by the Architect.

3. At toilet rooms also provide with 2" high raised gender and wheelchair symbols when handicapped equipped noted on schedule. Symbols shall be chemically welded through the face laminate to the acrylic core. Edges painted a color as selected.
4. The raised copy shall be accompanied with grade 2 Braille by means of Visi Touch DuraDot Braille manufacturing system. The clear Glass DuraDot shall have a 0.059 surface diameter and raised 1/32" above the face laminate and shall be unitized to the acrylic core through the face laminate. The edges of the sign shall be finished to match the face laminate color-to color as selected by the Architect. Any secondary copy shall be 8-stroke computer engraved. Rounded corner letters will not be acceptable.
5. Installed plaques shall comply with all state, local, and federal requirements for compliance.

B. EXTERIOR/INTERIOR BUILDING IDENTIFICATION LETTERS

1. Scope: The project shall include a cast letters as described below, to be provided and installed by contractor. Letterstyle, finish and mounting to be selected by Architect.

2. Fabrication of Letters: Fabricate letters to comply with requirements indicated below and as indicated on drawings.

   A . Cut letters : Form letters by cutting from solid sheet material of thickness specified. Produce characters with smooth flat faces, sharp corners, precisely formed lines and profiles, free from pits, scale, sand holes and other defects. Supply anchoring devices on reverse side of individual letters as required.

3. Characteristics:
   A. Metal: Aluminum
   B. Size: 8" and 6" as indicated on drawings.
   C. Thickness: 1 1/2 inches.
   D. Letterstyle: Sans Serif
   E. Finish: As selected by Architect from manufacturer's finish options (submit samples).
   F. Mounting: Concealed (refer to drawings for wall type).
   G. Text: "BRUSH COUNTRY G.C.D."
   "BRUSH COUNTRY GROUNDWATER CONSERVATION DISTRICT"

4. Template: Provide full size paper mounting template showing hole placement and location of mounting holes.

5. Finishes: Colors and surface textures for exposed letters as selected by the architect from the manufacturer's standard and ***premium*** selections.

C. BUILDING IDENTIFICATION PLAQUE:

1. 18" wide X 24" high cast bronze alloy plaque. Borders and raised text shall have satin finish. Background shall receive a dark oxidized leatherette finish. Faces and edges to be chemically cleaned and sprayed with two coats of clear acrylic lacquer.

2. Provide threaded stainless steel or brass studs on back for concealed mounting with epoxy. Letter style "Helvetica Medium" per A.R. Ramos or equivalent by specified manufacturer.

3. Layout, logos and letter sizes to be provided by the Architect. General contractor shall perform all conversions of architectural drawings & logos into useable vector line art format or any other type of format as required in order to produce the building plaque layout as provided by the Architect.

3 PART THREE- EXECUTION

3.1 INSPECTION AND PREPARATION

A. Ensure that wall surfaces are completed and accepted by the Architect prior to installing wall-mounted items or painted wall graphics.

B. Obtain approved location schedule for Room Identification Plaques prior to delivery of plaques to the jobsite.

3.2 INSTALLATION

A. ROOM IDENTIFICATION PLAQUES:

1. Apply top and bottom strips of 1/8” thick double stick vinyl foam tape and backs of each plaque. Apply liberal amount of clear silicone rubber adhesive to a minimum of 50% coverage of back of plaque.

2. Plaques shall be mounted to the strike side of the door on the wall within 5’ of the floor and 6” max. from the jamb; when location is on a glass side light or window, mount with a solid color back-up plate to cover reverse side of the glass. Attachment shall be with foam tape and silicone.

B. BUILDING DIRECTIONALS SIGNS:

1. Apply top and bottom strips 1/8” thick double stick vinyl foam tape on backs of each sign. Apply liberal amount of clear silicone rubber adhesive to a minimum of 50% coverage of back of sign.

2. Signs shall be mounted to the strike side of the door on the wall within 5’ of the floor and 6” max. from the jamb; when location is a glass sidelight or window, mount with a solid color back-up plate to cover reverse side of the glass. Attachment shall be with foam tape and silicone.

C. EXTERIOR/INTERIOR BUILDING IDENTIFICATION LETTERS.

1. Pre-drill holes into masonry and insert threaded stud on back of letters into epoxy adhesive filled holes. Provide stainless steel spaces to set letters off wall ½” minimum 2 studs per letter. Refer to drawings for wall finish type.

D. BUILDING IDENTIFICATION PLAQUE:

1. Masonry Wall: Pre-drill holes into masonry walls and insert threaded studs on back of letters into epoxy adhesive filled holes. Mount plaque tight against wall.

2. Drywall: Mount plaque using a minimum of 4 moly type expansion screws and silicone adhesive. Mount plaque tight against wall.

END OF SECTION

SECTION 10 14 53 — TRAFFIC STRIPING AND PARKING SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide traffic line, parking stripe and symbol painting on concrete/asphalt paving as indicated in the drawings.

B. Provide and install pipe-mounted parking signs at handicapped parking spaces meeting requirements of ADA.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Reinforced concrete paving.

1.4 SUBMITTALS

A. PAINT: Submit manufacturer’s product literature indicating Federal specification numbers and manufacturer’s recommended use and application techniques.

B. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

C. Provide full size template for handicapped stall symbol.

1.5 WARRANTY

A. Provide written warranty against defects in material and workmanship for a period of one year after date of Substantial Completion.

B. Warranted defects for paint striping shall include but not necessarily be limited to fading, bleed-thru, spalling, excessive wear or delamination.

PART 2 - PRODUCTS

2.1 MATERIALS

A. PAINT: "Traffic-Line" alkyd base marking paint meeting Federal Specifications TTP-85 and TTP-115 Type 1 as manufactured by Devoe or equivalent.

1. Width: Typically 4 inches unless indicated otherwise in the drawings.
2. Colors:

a. White: Traffic lines, directional symbols, symbols for the handicapped.
b. Yellow: Striping for parking stalls.

B. HANDICAPPED PARKING SIGNS:

1. Provide sign size, colors and copy meeting state, local and federal requirements for handicapped parking signage.
2. Sign blank shall be 1/8" aluminum sheet with Dupont "Emron" glass paint background, graphics and copy.
3. Graphics and copy shall be photo silk screened.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure that paving operations are complete and surfaces thoroughly dry, clean, and free of oil or grease stains or other contaminants.

B. Clean with high pressure wash or brush if necessary for proper adhesion.

3.2 PAINT

A. Spray apply two coats of marking paint in patterns indicated on the drawings after weathering of asphalt or concrete paving for a minimum of 30 days. Edges shall be sharply defined.

B. Provide minimum dry thickness of 2.5 mils. Provide additional coats if required for complete hiding.

3.3 HANDICAPPED PARKING SIGNS: Set 2" galvanized pipe sign support in minimum 6" diameter x 24" deep concrete footing.

END OF SECTION

SECTION 10 21 13 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide and install **solid phenolic toilet partition system and urinal screens** as indicated in the drawings, the approved shop drawings and as specified herein.

B. Provide and install all toilet room accessories as indicated in the drawings and as specified herein.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Wood blocking between studs.

B. Wall and floor finishes.

C. Electrical power provided.

1.4 SUBMITTALS

A. SOLID PHENOLIC PARTITION SYSTEMS:
1. Submit shop drawings for solid phenolic partition system indicating plan and elevation dimensions and mounting details. Submit hardware samples and full chain of melamine samples for partition doors.
2. Shop drawings indicating handicapped stall layouts not meeting State and Federal requirements will be returned and rejected without review.

B. ACCESSORIES:
1. Submit manufacturer’s product data describing size, type, finish and installation requirements for each item.
2. Indicate mounting heights for each item. Meet State and Federal requirements for the handicapped.

C. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

1.5 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

B. Warranted defects shall include but not necessarily be limited to delamination of facing or edging, swelling of core, change in alignment of parts, failure of anchorage or fasteners.

C. Provide manufacturer's extended written warranty for systems and accessories where available.

1.6 QUALITY ASSURANCE

A. Partition system installation company shall have a minimum of 5 years experience in the installation of similar system for projects of similar size and scope.

B. Partition system installation company shall be authorized by the system manufacturer for this installation.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver partition system materials to the job site in manufacturer's original packaging.

B. Store materials in covered, dry, temperature and humidity controlled space.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. SOLID PHENOLIC PARTITION SYSTEMS:
1. Bobrick Washroom Equipment
2. American Specialties, Inc.
3. Ampco
4. General Partitions

B. ACCESSORY MANUFACTURERS:
1. Bobrick Washroom Equipment
2. Bradley Wash Fountain Co.

C. PAPER TOWEL DISPENSERS:
1. Bobrick Washroom Equipment

2.2 TOILET ROOM ACCESSORIES:

1. Grab bars: Furnish and install grab bars at each handicapped toilet stall. Bars shall be Bobrick No. B-6806 series, 1-1/2" outside diameter, satin finish stainless steel, configuration as indicated on the drawings, 1-1/2" clear to wall. **Where bars are mounted over back of toilet, General Contractor shall hold flush valve low.**

2. Mirrors: Mirrors shall be ¼" plate glass, mirror quality, with copper backs. Provide polished stainless steel or brass chrome plated frames in sizes indicated on the drawings.
   a. Tilted mirrors shall be Bobrick No. B-293 or equivalent by specified manufacturer.
   b. Flat mirrors shall be Bobrick No. B-290 or equivalent by specified manufacturer.

3. Mop Holder: Bobrick B223X24 stainless steel. Furnished and installed by Contractor.

4. Soap dispensers: Bobrick Contura Series Surface Mounted Soap Dispenser Model B-4112. Furnished and installed by Contractor.

5. Tissue dispensers: ClassicSeries Surface-Mounted Toilet Tissue Dispenser for Two Rolls Model B-265 of Bobrick Washroom Equipment, Inc. Furnished and installed by Contractor.

6. Paper Towel Dispensers: Recessed Paper Towel Dispenser and Waster Receptacle shall be Model B-369 of Bobrick Washroom Equipment, Inc. Furnished and installed by Contractor.

7. Clothes hooks: Surface mounted clothes hooks Model B-981 of Bobrick Washroom Equipment, Inc.

2.3 SOLID PHENOLIC PARTITION SYSTEMS:

A. STILES, PANELS, DOORS, SCREENS, BENCHES

1. Solid phenolic material constructed of solidly fused plastic laminate with matte-finish melamine surfaces, colored face sheets, and black phenolic-resin core that are integrally bonded. Edges shall be black. Brown edges shall not be acceptable. Color and pattern as selected by architect from manufacturer's standard colors.

2. Solid phenolic material shall meet National Fire Protection Association and International Build ing Code Interior Wall and Ceiling Finish Class A, Uniform Building Code Class I, ASTM E-84 Fire Resistance Standards; flame spread 20, smoke density 95.

3. Finish Thickness
   a. Stiles and doors shall be 3/4" (19mm).
   b. Panels and benches shall be 1/2" (13mm).

B. HARDWARE

1. All hardware to be 18-8, type-304 stainless steel with satin-finish.

2. All hardware shall be concealed inside compartments with the exception of outswing doors.

3. Hardware of chrome-plated "Zamak" is unacceptable.

C. LATCH

1. Sliding door latch shall be 16-gauge (1.6mm).

2. Sliding door latch shall require less than 5-lb force to operate. Twisting latch operation will not be acceptable.

3. Latch track shall be attached to door by flathead machine screws into factory installed threaded brass inserts.

4. Latch handle shall have rubber bumper to act as door stop.

5. Latch shall allow door to be lifted over 16-gauge (1.6mm) keeper for emergency access.

6. Metal-to-metal connection shall withstand a direct pull of over 1,500 lb. per screw.

D. HINGES

1. Cam shall be adjustable in the field to permit door to be fully closed or partially open when compartment is unoccupied.

2. Hinges shall be attached to door and stile by theft-resistant, one-way stainless steel machine screws into factory-installed metal inserts. Fasteners secured directly into the core are not acceptable.

3. Metal-to-metal connection shall withstand a direct pull of over 1,500 lb. per screw.

E. Clothes Hook shall be constructed of stainless steel and shall project no more than 1-1/8" (29mm) from face of door. Clothes hook shall be secured by theft-resistant, one-way stainless steel screws.

F. Mounting Brackets shall be constructed of stainless steel and shall be mounted inside compartment. Mounting brackets exposed on the exterior of the compartment will not be acceptable. Wall mounted urinal screen brackets shall be 11-gauge (3mm) double thickness.

G. Leveling Device shall be 3/16" (5mm) hot rolled steel bar; chromate-treated and zinc-plated; through bolted to base of solid phenolic stile.

H. Stile Shoe shall be one-piece, 4" (102mm) high, type-304, 22-gauge (0.8mm) stainless steel with satinfinish. Top shall have 90° return to stile. Patented one-piece shoe capable of adapting to 3/4" or 1" stile thickness and capable of being fastened (by clip) to stiles starting at wall line.

I. Headrail (Overhead-Braced) shall be satin finish, extruded anodized aluminum (.065" / 1. 65mm thick) with anti-grip profile. Type: Floor mounted, overhead braced continuously over entire system.

PART 3 - EXECUTION

3.1 INSPECTION

A. Ensure that Contractor has properly installed solid wood blocking between studs at all mounting points.

3.2 INSTALLATION

A. Install accessories and partition systems in accordance with the project drawings, approved shop drawings and as specified herein. Use tamper proof stainless steel fasteners for all items.

B. ACCESSORIES:
1. Install through finished stud walls into solid wood blocking with stainless steel one-way screws. No plastic anchors.
2. Attach to masonry walls using stainless steel machine screws in lead shield anchors.

C. PARTITION SYSTEMS AND URINAL SCREENS:
1. Mount channels using stainless steel one-way screws through finished stud walls into solid wood blocking.
2. Mount channels to masonry walls using stainless steel machine screws in lead shield anchors.
3. Job measure for proper fit and to ensure that the maximum space between edge of any pilaster or panel and its adjacent surface is one inch.
4. Install pilaster, doors and panels plumb and square. Adjust doors for gravity closing.

D. FRAMED MIRRORS:

1. Mirrors shall be installed with theft-proof anchors at height shown on drawings. Furnish tilted mirrors where shown.
2. Install mirrors at other locations in addition to toilet rooms as indicated in the drawings.
3. Unframed mirrors are provided and installed under another section of these specifications.

END OF SECTION

Altro Puraguard Protective Wall Covering

SECTION 10 26 23 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section includes labor, materials and other services necessary to complete vinyl wall coverings.

B. Conform with requirements of all Sections of Division 1, General Requirements, as it applies to the work of this Section.

1.2 RELATED SECTIONS

A. Section 09 21 16 – Gypsum (Cementitious) substrate board.
B. Section 05 41 00 – Wood (Metal) Stud Framing.
C. Section 09 91 00 – Painting & Transparent Finishes

1.3 REFERENCES

A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

B. **American Society for Testing & Materials (ASTM):**
1. AST ASTM E 84-05 Standard Test Method for Surface Burning Characteristics of Building Materials. CLASS A
2. ASTM D5420 Gardner Impact Exceeds 80 inch pounds

1.4 SYSTEM DESCRIPTION

A. Performance Requirements: Provide Altro Puraguard™ wall covering which has been manufactured by Altro to maintain performance criteria stated by manufacturer without defects.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's current printed product literature, specifications, installation instructions, and field reports in accordance with Section 01330 - Submittal Procedures.

B. Shop Drawings: Submit shop drawings to indicate materials, details, and accessories in accordance with Section 01330 - Submittal Procedures including but limited to the following:
1. Submit a layout diagram indicating the location of each panel and joining method.

C. Samples: Submit duplicate sample pieces of Altro Puraguard™ material, as well as accessory pieces in accordance with Section 01330 - Submittal Procedures.

D. Quality Assurance Submittals: Submit the following:
1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
2. Manufacturer's Instructions: Current published manufacturer's installation and maintenance instructions.
3. Manufacturer's Field Reports: Specified herein.

E. Closeout Submittals: Submit the following:
1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
2. Warranty: Warranty documents specified herein.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of

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work similar to that required for this project.

1. Training: Installer who has a min. of five years of experience installing wall covering.

C. Mock-ups: Install at project site a job mock-up using acceptable products and manufacturer approved installation methods. Obtain Owner's and Consultant's acceptance of finish color, texture and pattern, and workmanship standards.
   1. Mock-Up Size: [Specify mock-up size.].
   2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
   3. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.

D. Pre-installation Meeting: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

1.7 DELIVERY, STORAGE & HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Deliver, store and handle Altro Puraguard™ wall panels in accordance with Section 01610 - Basic Material Requirements.

C. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer.

E. Store panels in temperature controlled environments. Leave protective blue film on panel until ready to use.

1.8 WASTE MANAGEMENT AND DISPOSAL

A. Deposit all packaging materials in appropriate container on site for recycling or reuse.

B. Avoid using landfill waste disposal procedures when recycling facilities are available.

C. Keep all discarded packaging away from children.

1.9 PROJECT CONDITIONS

A. Temperature Requirements: If storage temperature is below 65F (18C), the Altro Puraguard wall panel must be moved to a warmer place and allowed to reach this temperature before installation. For further information, refer to current Installation Guide.

B. Maintain air temperature and structural base temperature at installation area between 65F (18C) and 80F (26C) for 48 hours before, during and 24 hours after installation.

1.10 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

Note: Altro Puraguard wall covering has been manufactured by Altro to maintain performance criteria stated by manufacturer without defects.

C. Warranty Period for Altro Puraguard shall be 1 year commencing on Date of Substantial Completion. Please see current Altro Puraguard Warranty online at www.altro.com

PART 2 PRODUCTS

Note: For information on Altro Puraguard™ Wall Protection for Commercial Kitchens, contact Altro directly to obtain information and assistance.

2.1 MANUFACTURERS

A. Manufacturer: Altro
1. USA: 80 Industrial Way, Wilmington MA 01887
Toll-free: 800.377.5597 Fax: 610.746.4325
E-mail: support@altro.com Web Site: www.altro.com.

2.2 PVCu WALL COVERING (FOR COMMERCIAL KITCHENS)

A. Altro Puraguard™ is a semi-rigid PVCu panel. Altro Puraguard™ contains no plasticizers or fillers. Altro Puraguard™ is homogenous.

B. Acceptable material: Altro Puraguard™ (measurements and product weights given below are approximate):

1. **Salt W139:** Thickness: 0.080" (2.0 mm); Panel Width: 4’ (1.22m) Panel Height 9’ (2.44m) Weight per panel: 21.05 lbs (9.5 kg)

2. **Salt W135:** Thickness: 0.080" (2.0 mm); Panel Width: 4’ (1.22m) Panel Height 10’ (3.05m) Weight per panel: 23.37 lbs (10.6 kg)

3. **Barley W140/300:** Thickness: 0.080" (2.0 mm); Panel Width: 4’ (1.22m) Panel Height 9’ (2.44m) Weight per panel: 21.05 lbs (9.5 kg)

4. **Barley W141/300:** Thickness: 0.080" (2.0 mm); Panel Width: 4’ (1.22m) Panel Height 10’ (3.05m) Weight per panel: 23.37 lbs (10.6 kg)

5. **Pepper W140/301:** Thickness: 0.080" (2.0 mm); Panel Width: 4’ (1.22m) Panel Height 9’ (2.74m) Weight per panel: 21.05 lbs (9.5 kg)

6. **Pepper W141/301**: Thickness: 0.080" (2.0 mm); Panel Width: 4’ (1.22m) Panel Height 10’ (3.05m) Weight per panel: 23.37 lbs (10.6 kg)

7. **Sea Salt W140/400** (pebble finish): Thickness: 0.080" (2.0 mm); Panel Width: 4’ (1.22m) Panel Height 9’ (2.74m) Weight per panel: 21 lbs (9.52 kg)

8. **Sea Salt W141/400** (pebble finish)**:** Thickness: 0.080" (2.0 mm); Panel Width: 4’ (1.22m) Panel Height 10’ (3.04m) Weight per panel: 24 lbs (10.89 kg)

2.3 ACCESSORIES

A. Joint Strips:
1. 1-Part Joint Strip – [G731/30 White, 300 Barley, 301 Pepper] 10’

B. Start and Edge Trim:
1. 2-Part Start and Edge Trim – [G733/30 White, 300 Barley, 301 Pepper] 10’

C. Corners, Covers and Gasket Trims:
1. Internal/External Corner [A826/30 White, White, 300 Barley, 301 Pepper] 10’
2. External Corner Cover [A839/30 White, White, 300 Barley, 301 Pepper] 10’
3. Altrotite Gasket Trim [A840/30 White, White, 300 Barley, 301 Pepper] 10’

D. Optional Accessories:
1. Stainless Steel Corner Protector – [A861/12 Brushed Steel] Dimensions: 4’ x 3” x 3”
2. C4 Cap Strip – [C4 CAP White, 300 Barley, 301 Pepper] Length 8’2”
3. C8 Cap Strip – [C8 CAP White, 300 Barley, 301 Pepper] Length 8’2”

E. Acrylic Adhesive: For dry, climate controlled areas, use AltroFix W157, a one-part, water-based, acrylic adhesive as

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recommended by manufacturer.

F. Polyurethane Adhesive: The default adhesive for most installations, suitable for wet area, non-climate controlled areas, and non-absorbent surfaces, use AltroFix W39, a two-part resin-based polyurethane adhesive as recommended by manufacturer.

G. Spray Adhesive: For surfaces in dry climate controlled areas and for most all absorbent and non-absorbent surfaces, use Altro W147, a versatile water-based acrylic blend spray adhesive.

H. Sanitary Sealant and Mastic Compounds and Tools:
1. Altro Sanitary Sealant – [A802 White/A803 Clear/A806* Colors) 10.5 oz

2.4 SOURCE QUALITY

A. Source Quality: Obtain wall products from a single manufacturer.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog, installation instructions and product label instructions for installation.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

3.3 SUBSTRATE PREPARATION

A. Walls should be smooth and level. High points must be removed and low points filled with filler intended for the substrate and environmental conditions.

B. Surfaces must be permanently dry and free from all substances that may contribute to adhesive bond failure.

C. Remove loose paint and conduct an adhesive bond test with paint.

D. Exterior walls must be adequately damp-proofed and insulated.

E. Dry wall substrates should be paint ready.

3.4 PREPARATION

A. All surfaces must be free from dust and cleaned prior to Altro Puraguard™ installation. The working environment must also be dust free. Failure to comply with these conditions will reduce the bond strength between the adhesive and substrate, and may cause the Altro Puraguard™ panels to de-bond.

B. All electrical switches, power points etc., should be in a first fix / installation state. All electrical equipment should only be moved or altered by a qualified electrician.

C. All plumbing should have pipe-work removed to a first fix or installation state and "tails" left protruding from the substrate. Altro Puraguard™ panels can then be drilled and slid over the pipe tails. All holes should be drilled 1/8" (3mm) oversize to allow for expansion, then sealed with Altro Sanitary Sealant. Plumbing should always be done by a qualified plumber.

D. Hot pipes and steam pipes should be insulated and a 1/8" to 1/4" (3-6mm) expansion gap should be created when installing panels around these pipes, then sealed with Sanitary Sealant.

E. All pipes, fixing bolts, etc. extending through the Altro Puraguard™ panels should have a minimum 1/8" (3mm) expansion gap and be sealed using Sanitary Sealant.

F. If fitting to door frames, these must be in place prior to installation of Altro Puraguard™.

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G. Prior to installation, it is advisable to complete any painting which comes in contact with Altro Puraguard™, as sealant used at junctions is non-paintable.

H. Panels should be stored flat and be pre-conditioned a minimum of 24 hours in ambient temperatures similar to the prevailing operational conditions.

I. The panels must be stored on a level flat surface off the ground (risk of condensation on the panels if stored on damp surfaces). Storage on uneven surfaces could cause the panels to distort prior to installation.

J. First, check the room using a 6' (2 m) level to ensure all walls are flat, paying particular attention to the corners, window reveals, and door entrances. These need to be inspected to ensure they are free of any debris or irregularities, which could prevent the panels from laying flat to the substrate after the adhesive has been applied and the panel installed.

3.5 INSTALLATION

A. PVC Wall Installation: Install Altro Puraguard™ in accordance with the current Altro Puraguard™ Installation Guide.

3.6 FIELD QUALITY REQUIREMENTS

A. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

1. Site Visits: [Specify number and duration of periodic site visits.].

3.7 CLEANING

Note: Once all panels and joints are installed, remove protective film and clean all surfaces down with antistatic solution or antistatic wipes. This is required as the panel may have static build up and any dust in the atmosphere will adhere to the surface of the panel.

A. Altro Puraguard™ can be cleaned with a diluted soap/detergent solution, such as Altro 44 Cleaner.

B. When cleaning the Altro Puraguard™ surface, we recommend the temperature of water does not exceed 140° F (60° C).

C. Pressure cleaning with hot water may be used with the pressure nozzle a minimum of 2 feet (600mm) away from the surface, not recommended with acrylic adhesive installations.

D. To reduce the buildup of static, cleaning the panels with an anti-static solution is recommended.

E. For scuff marks, we recommend using a cream cleaner such as Altro A859/325.

Specifier Note: If a construction waste separation and disposal work plan is incorporated as part of the project, ensure that this section makes reference to how the excess material can be recycled or otherwise disposed of. Avoid sending construction waste to landfill sites if alternative means of disposal are available.

A. Remove construction debris from project site and legally dispose of debris.

3.8 PROTECTION

B. Do not install near open heat sources (ovens, etc). Stainless steel panels should be used in such areas.

END OF SECTION

SECTION 10 44 00 - FIRE EXTINGUISHERS AND CABINETS

PART 1 GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 RELATED SECTIONS

A. Section 04 22 00 – Concrete Masonry Units; CMU walls to receive bracket mounted fire extinguisher.

B. Section 06 10 00 – Rough Carpentry: Wood blocking and framing to receive semi-recessed fire extinguisher cabinets.

C. Section 09 21 16 – Gypsum Drywall Assemblies: Finished openings in walls for semi-recessed fire extinguisher cabinets.

1.03 REFERENCES

A. NFPA 10 – Standard for Portable Fire Extinguishers; National Fire Protection Association; 2002.

B. UL (FPED) – Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.04 PERFORMANCE REQUIREMENTS

A. Conform to NFPA 10.

B. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

1.05 SUBMITTALS

A. See Section 01 33 00 – Submittals, procedures and requirements for shop drawings, product data and submittal requirements.

B. Shop Drawings: Indicate cabinet physical dimensions.

C. Product Data: Provide extinguisher operational features.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers, Cabinets and Accessories:
1. JL Industries, Inc; Product 1037B20 with Extinguisher: www.jlindustires.com.
2. Larsen's Manufacturing Co: www.larsensmfg.com.
3. Potter-Roemer: www.potterroemer.com.
4. Substitutions: See Section 01 25 00 – Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Basis of Design: JL Industries, "Cosmic 10E".
B. Type: Multipurpose dry chemical.
C. Rating: Sized for project requirements.
D. Mounting: Refer to floor plans for locations, annotated FEC for cabinets and FE extinguishers alone.
E. Dry Chemical Type: Stainless steel tank, with pressure gage.
1. Class A:B:C.
2. Size 10.
3. Finish: Baked enamel, Red color.

G. ALL fire extinguishers shall be inspected and certified by the local authority having jurisdiction that they are charged and ready for use and shall be "tagged" identifying such.

2.03 FIRE EXTINGUISHER CABINETS

A. Basis of Design:
1. JL Industries, "Cosmopolitan – 1035B20 ADAC with Saf-T-Loc, TAS compliant.
2. Designations: Refer to the floor plans, FEC for Extinguishers in cabinets and FE for surface mounted extinguishers secured to walls.

B. Surface Mounted (Non-Cabinet, FE Type) – Bracket and Extinguisher (non-cabinet): Manufacturer's standard stainless steel strap with enamel finished bracket with locking band retainer.
   1. Bracket shall match the extinguisher type.

C. Metal for Cabinets: Formed stainless steel sheet; 0.036 inch thick base metal; #4 finish stainless steel.

D. Cabinet Configuration: Recessed type.

   1. Sized to accommodate accessories.
   2. Exterior nominal dimensions of 13 7/8 inch wide x 27 3/8 inch high x 6 inch deep.
   3. Trim: Returned to wall surface, with 3 inch projection, 1 1/2 inch wide face.
   4. Form cabinet enclosure with right angle inside corners and seams. Form perimeters trim and door stiles.

E. Door: 0.036 inch thick, reinforced for flatness and rigidity; lock with full glass access. Hinge doors for 180 degree opening with two butt hinge. Provide nylon catch.

F. Door Glazing: Glass, clear, 1/8 inch thick float. Set in resilient channel gasket glazing.

G. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.

H. Weld, fill, and grind components smooth.

I. Finish of Cabinet Interior: Enamel, color to select from manufacturer's full color line.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Cabinet Signage: FIRE EXTINGUISHER, vertical up face of cabinet to one side.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install cabinets plumb and level in wall openings, 30 inches from finished floor to inside bottom of cabinet.
C. Secure rigidly in place.
D. Place extinguishers in cabinets.

END OF SECTION

SECTION 10 73 16 – ALUMINUM CANOPIES

PART 1 GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 DESCRIPTION OF WORK

A. Work in this section includes furnishing and installation of roll-formed aluminum overhead hanger rod style canopies.

B. Related Items and Considerations

1. Flashing of various designs may be required. Generic flashing supplied by manufacturer. Specialty flashing to be supplied by installer.
2. Determine wall construction, make-up and thickness.
3. Ensure adequate wall condition to carry canopy loads where required.
4. Consider water drainage away from canopy where necessary.
5. Any necessary removal or relocation of existing structures, obstructions or materials.

1.2 QUALITY ASSURANCE

A. Products meeting these specifications established standard of quality required by manufacturer.

1.3 FIELD MEASUREMENT

A. Confirm dimensions prior to preparation of shop drawings when possible.

B. If requested, supply manufacturer’s standard literature and specifications for canopies.

C. Submit shop drawings showing structural component locations/positions, material dimensions and details of construction and assembly.

1.4 PERFORMANCE REQUIREMENTS

A. Canopy must conform to local building codes.

B. Professional Engineer Stamped calculations are required and must be signed and sealed by an engineer licensed within the state canopy is installed.

1.5 DELIVER, STORAGE, HANDLING

A. Deliver and store all canopy components in protected areas.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Mapes Canopies
Lincoln, Nebraska
Phone: 1-888-273-1132.
Fax: 1-877-455-6572.

B. Substitutions in accordance with Section 01 25 00.

2.2 MATERIALS

A. Decking shall consist of an interlocking roll-form 2 1/2 W style pan (.032" aluminum).

B. Intermediate framing members shall be extruded aluminum, alloy 6063-T6, in profile and thickness as per manufacturer recommendations.

C. Hanger rods and attachment hardware shall be a standard finish.

D. Fascia shall be standard extruded 8" J style.

2.3 FINISHES

1. Finish type shall be 2-Coat Kynar Finish.

2.4 FABRICATION

A. All canopies shall be shipped in preassembled sections for ease of installation.

B. All connections shall be mechanically assembled utilizing 3/16 fasteners with a minimum shear stress of 350 lb. Pre-welded or factory-welded connections are not acceptable.

C. Decking shall be designed with interlocking roll-formed aluminum members.

D. Concealed drainage. Water shall drain from covered surfaces into intermediate trough and be directed to Front Scupper.

PART 3 EXECUTION

3.1 INSPECTION

A. Confirm that surrounding area is ready for the canopy installation.

B. Installer shall confirm dimensions and elevations to be as shown on drawings provided by Mapes Industries.

C. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and roofing in the area is completed.

3.2 INSTALLATION

A. Installation shall be in strict accordance with manufacturer's shop drawings. Particular attention should be given to protecting the finish during handling and erection.

B. After installation, entire system shall be left in a clean condition.

END OF SECTION

SECTION 10 75 00 - FLAGPOLES

PART 1 GENERAL

1.0 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division-1 specification section, apply to work of this section.

1.2 SESSION INCLUDES:

A. Aluminum flagpoles, ground mounted.

1.3 REFERENCES

A. AASHTO M246/M246M Standard Specification for steel sheet, metallic-coated and polymer pre-coated for corrugated steel pipes.
B. ASTM A53/A53M-02 Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
C. ASTM A123/A123M-02 - Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.
D. ASTM A790/A790M-02 Standard Specification for Seamless and Welded Ferrite/Austenitic Stainless Steel Pipe
E. ASTM B221-02 Aluminum Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
F. ASTM B241/B241M-02 Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
G. CDA (Copper Development Association) - Handbook.

1.4 PERFORMANCE REQUIREMENTS

A. The General Contractor shall furnish and install a tapered aluminum flagpole, complete with a 50-star U.S. Flag, and a State of Texas flag, and all fittings, top ornament, lighting, ground spike with plate, foundation, grounding facilities, and all appurtenant work, all in accordance with the requirements of the Contract Documents.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00.
B. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements and imposed loads.
C. Product Data: Provide product data on pole, accessories and configurations.

1.6 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Provide lubrication and periodic maintenance requirement schedules.

1.7 QUALIFICATIONS

A. Design flagpole foundation under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Texas. Provide calculations.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01 60 00.
B. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.
C. Protect flagpole and accessories on site from damage or moisture.

PART 2 PRODUCTS

2.1 POLE MATERIALS

A. Aluminum: ASTM B241; 6063 alloy, T6 temper.

2.2 POLE CONFIGURATION

A. Nominal Height: 25 ft measured from nominal ground elevation.
B. Flagpole: Ground mounted type.
C. Flagpole Design: Cone tapered, seamless.
D. Halyard: External type.

2.3 COMPONENTS AND ACCESSORIES

A. Finial Ball: 6" diameter, spun aluminum.
B. Truck Assembly: Cast aluminum; revolving, stainless steel ball-bearings, non-fouling.
C. Flags: (1) U.S.A. design, 8 x 5 feet size, nylon fabric, brass grommets, hemmed edges.
(1) Texas design, 8 x 5 feet size, nylon fabric, brass grommets, hemmed edges.
D. Cleats: Aluminum with stainless steel fastenings, two per halyard.
E. Cleat Box: Aluminum with built-in hinge and hasp assembly, attached to pole with tamper proof screws inside box.
F. Halyard: 3/8" diameter polypropylene, braided, white.

2.4 MOUNTING COMPONENTS

A. Foundation Tube Sleeve: AASHTO M-246, corrugated 16-gage steel, galvanized.
B. Pole Base Attachment: Flush, aluminum base with base cover.
C. Lightning Ground Rod: Copper rod, 3/4" diameter; design length.

2.5 FINISHES

A. Metal Surfaces in Contact with Concrete: Asphaltic paint.
B. Concealed Steel Surfaces: Galvanized to ASTM A123 1.25 oz/sq ft.
C. Aluminum: Anodized to color as selected.
D. Finial: Spun and Lacquered.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions under provisions of Section 01 03 90.
B. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

3.2 PREPARATION

A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.3 INSTALLATION

A. Install flagpole, base assembly, and fittings in accordance with manufacturer's instructions.
B. Electrically ground flagpole installation.
C. Fill foundation tube sleeve with sand specified in Section 02 22 30 and compact.
D. Install foundation plate and centering wedges, welded base assembly for flagpoles base set on concrete base and fasten.

3.4 ERECTION TOLERANCES

A. Maximum Variation From Plumb: One inch

3.5 ADJUSTING

A. Adjust work under provisions of Section 01 70 00.
B. Adjust operating devices so that halyard and flag function smoothly.

END OF SECTION

SECTION 12 21 13 - HORIZONTAL LOUVER BLINDS

PART 1 – GENERAL

1.00 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.01 DESCRIPTION

A. Material and installation of 2" Horizontal Louver Blinds With Aluminum Slats at each window location.

1.02 SUBMITTALS

A. Manufacturer’s complete CSI 3- part specification sheet.
B. Submit working hand sample or mock up blind as required.
C. Submit two 6" samples of aluminum slat indicating color and dimensions.
D. Approval of submittals by Architect shall not relieve contractor from installing blinds with adequate clearance to permit smooth operation of the blinds and demonstrating blinds to be in smooth, uniform working order. Contractor must field verify all dimensions.

1.03 DELIVERY, STORAGE AND HANDLING

A. Product to be delivered in manufacturer’s original packaging.
B. Products to be handled and stored to prevent damage to materials, finishes and operating mechanisms. Store in a clean, dry area, laid flat to prevent sagging and twisting of packaging.

1.04 EXTRA STOCK

A. Describe extra attic stock as required: One (1) additional horizontal louver blind.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Springs Window Fashions LLC or approved architect equivalent.
B. Substitutions Request: Submit for approval under provisions of section 01 25 00.

2.02 HORIZONTAL BLINDS

A. Product: Bali® 2” Aluminum School Blinds

B. Color Name: As Selected by Architect; Color Number: As Selected by Architect.

C. SureClose® Headrail shall be 1 5/8" high x 2 1/4" wide x .022” thick U-shaped steel with 1/8” light blocking lip on the bottom centerline. The steel finishing process includes phosphate treatment for corrosion resistance, a chrome-free sealer, a low HAP urethane primer and a topcoat with low HAP polyester baked enamel.

D. Cord tilter shall be a snap-in component incorporating a worm and pulley of low-friction thermoplastic and a nylon gear. Standard tilt cords shall measure 2.2 mm in diameter.
Select One:
- ☒ Cord tilter (standard)
- ☐ Wand tilter
- ☐ Ring tilter

E. Cord lock shall be metal of a snap-in design incorporating a floating, shaft-type locking pin and shall incorporate a crash proof safety feature that will lock blind automatically upon release of cord
Options:
- ☐ Ring pull provides a single plated steel ring in lieu of tassels with a nominal 4" cord length.

F. Lift cord shall be made of braided polyester measuring 2.2mm in diameter.

G. Vinyl ladder tape shall be 1 1/2” wide reinforced vinyl. Standard ladder spacing shall be 42mm.
Select One Vinyl Tape Color:
- ☐ 005 White
- ☐ 670 Creamy Beige
- ☐ 904 Lamplight
- ☐ 983 Gray Haze
- ☐ 062 Char Brown

H. Slats shall be 5000 series cold-rolled aluminum containing the maximum allowable recycled content to produce a high strength and corrosion resistant flexible product. Slats shall be nominally 2” wide x .008" thick and treated with Advanced Finishing Technology (AFT), providing a smooth, hard, less porous surface. AFT delivers anti-static performance to repel dust and anti-microbial qualities to resist fungal and bacterial growth. Slats shall be treated with a chrome-free sealer and a topcoat of low HAP polyester baked enamel.

I. Bottomrail shall be “C” shaped 9/16” high x 2” wide x .040 thick anodized aluminum. It is fully enclosed with a dust cover slat and finished with a polyester baked enamel to match headrail.

2.03 FABRICATION

A. Blinds shall be fabricated according to specifications and accurate to tolerance established by SWF engineering standards

PART 3 – EXECUTION

3.01 INSPECTION

A. Installer shall be responsible for inspection of jobsite, approval of mounting surfaces, verification of field measurements and installation conditions. Installation shall commence when satisfactory conditions are met.

B. Do not dimension the drawings. Any questions concerning dimensions should be directed to the Architect for clarification.

3.02 INSTALLATION

A. Install blinds in accordance with manufacturer's instructions including recommended support brackets and fasteners.

B. Install blinds with adequate clearance to permit smooth operation of the blinds. Demonstrate blinds to be in smooth, uniform working order.

3.03 MAINTENANCE AND CLEANING

A. Maintain and clean blinds in accordance with manufacturer's instructions.

END OF SECTION

SECTION 13 34 19 — PRE-ENGINEERED METAL BUILDINGS

PART 1 - GENERAL

1.00 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.01 SCOPE:

A. Provide all pre-engineered metal buildings, complete, as shown on the Drawings, specified herein, or needed for a complete and proper installation and not specifically called for under other Sections of these specifications.

B. The requirements of Division 0 – “Bidding and Contract Requirements” and Division 1 – “General Requirements” of this Project Manual apply to all work required for this section.

PART 2 - PRE ENGINEERED METAL BUILDING SYSTEM:

2.01 GENERAL:

A. The intent of these specifications and drawings is to establish a quality and performance level for structural design, material, durability, and workmanship.

B. All bidders must conform strictly to these specifications in their bid.

C. The building shall be the design of a manufacturer who is regularly engaged in the fabrication of pre-engineered structures. All materials shall be new, unused, free from defects and of American manufacture.

D. The following standards and criteria (of most recent issue) shall be used where applicable in the structural design of the building covered by this specification:

“MANUAL OF STEEL CONSTRUCTION”- American Institute of Steel Construction
“COLD FORMED STEEL DESIGN MANUAL” - American Iron and Steel Institute
“ALUMINUM CONSTRUCTION MANUAL” - The Aluminum Association
“CODE FOR WELDING IN BUILDING CONSTRUCTION” -American Welding Society

The following criteria shall also be applicable in other phases of design: latest edition of the INTERNATIONAL BUILDING CODE.

E. Listing by:

Underwriters' Laboratories Inc.
Factory Mutual System or other recognized testing laboratories

2.02 DESIGN LOADS:

A. GENERAL:

1. The basic design loads shall include live and wind, in addition to dead load. All other design loads, whether they be of static or dynamic nature, shall be considered as auxiliary loads.

B. VERTICAL LIVE LOAD:

1. Roof covering shall be designed for either 50 psf uniformly distributed or a 200-pound concentrated (point) load (over a 1' x 1' area) located at center of maximum roof (panel) span. The most severe conditions shall govern.
2. Purlins shall be designed for 20 psf uniformly distributed over the roof area which they support.
3. Primary framing (frames) shall be designed for 20 psf uniformly distributed over the roof area which it supports.
4. All the above loads to be in addition to the applicable dead loads and shall be applied to the horizontal projection of the roof.

C. WIND LOADS:

1. The wind load on the structure shall be proportioned and applied as horizontal and uplift forces according to and as recommended by the latest edition of the INTERNATIONAL BUILDING CODE.

2. The roof construction shall carry a U.L. Construction (Uplift) Listing of not less than Class 90.

3. Wind load may be proportioned as allowed by the latest edition of the INTERNATIONAL BUILDING CODE. However, such proportioning shall not compromise the UL-Class 90 listing.

D. AUXILIARY (ADDITIONAL COLLATERAL) LOADS:

1. Other superimposed dynamic and/or static loads shall be considered as part of the design requirements and combined with normal design (live and/or wind) loads as prescribed hereafter:

DYNAMIC LOADS: VARIOUS HVAC EQUIPMENT (REFER TO DRAWINGS FOR LOCATIONS).

STATIC LOADS: THE ROOF FRAMING AT 1:12 PITCH SHALL BE DESIGNED FOR AN AUXILIAR LOAD OF 5 PSI.

E. COMBINATION OF LOADS:

1. The combining of normal loads and auxiliary loads for design purposes shall be as prescribed and recommended by the latest edition of the INTERNATIONAL BUILDING CODE.

F. CERTIFICATION:

1. After the awarding of the Contract, complete structural analysis shall be submitted by the Metal Building Manufacturer to the Architect. Structural design must be sealed by a Texas Registered Professional Structural Engineer.

2.03 DESCRIPTION:

A. The pre-engineered metal buildings covered in this specification are to be rigid frame structure of steel (frames) rafter beams.

B. The roof slope shall be not less than 1”; 12” as indicated on the drawings.

C. Column spacing shall be as indicated on the drawings.

D. Nominal eave height shall be as indicated on the drawings.

2.04 ROOF COVERING AND SUPPORTS:

A. ROOF PANELS – Refer to Section 07 41 13 Insulated Metal Roof Panel.

B. PURLINS (ROOF COVER SUPPORT MEMBERS):

1. The configuration, thickness and spacing of the purlins shall be the Building Manufacturer’s standard. The allowance design capacity of cold-formed purlin members shall be calculated in accordance with the provisions of the AISI Specification for the Design of Cold-Formed Steel Structural Members.
2. The deflection of the purlin or secondary member shall not exceed L/180 of its span when supporting the applicable vertical live loads previously prescribed and any collateral loads required.
3. The standing seam roof does not provide a diaphragm or purlin bracing function. Brace purlins as required to conform with A.I.S.C. and A.I.S.I. specifications.

C. ROOF JACKS AND CURBS:

1. At roof penetrations for plumbing vents, install roof jacks (rubber) DEKTITE type where standing seam roofing is installed.

2. At roof penetrations for mechanical equipment skylights requires curbs; provide custom fabricated roof curbs as manufactured by CUSTOM CURB, INC., LCM INC.

2.05 RAKE, TRIM, GUTTERS, ROOF DOWNSPOUTS, TRIMS AND SOFFIT LINERS:

A. The closures, flashings, fascias, gutters, and trim shall be the Building Manufacturer’s standard, compatible with the material furnished as roof panels.

B. Buildings shall have continuous gutters with downspouts where shown on the drawings.

C. Gutters, downspouts, rake trim, ridge panels, and trim associated with standing seam roof panels shall be a color to be selected by Architect from manufacturer’s KYNAR 500 custom and to be part of base bid colors.

D. WARRANTY:

1. The exterior color finish for the metal panels shall be warranted by the Material Manufacturer and General Contractor for twenty (20) years against blistering, peeling, cracking, flaking, checking, and chipping. Excessive color change and chalking shall be warranted for twenty (20) years. Color change shall not exceed 5 N.B.S. units (per ASTM D-2244.64T) and chalking shall not be less than a rating of 8 per ASTM D-659.

E. GIRTS:

1. The girt's configuration and thickness shall be the Building Manufacturer's standard provided all design criteria, including deflection and girt spacing is met.

2. Based on a simple span, the deflection of the girts (supporting the wall covering) shall be proportioned with due regard to that produced by the previously prescribed design (wind) load.

2.06 STRUCTURAL STEEL PRIMER:

A. All uncoated structural steel shall be given one (1) coat of rust inhibitive (primer) paint which meets or exceeds Federal Specifications TT-P-664, or certification shall be submitted that it conforms to a recognized authoritative specification, such as from a Federal or Military authority or the Structural Steel Painting Council.

B. Exposed pre-engineered metal building must be painted with at least one (1) coat of primer and two (2) coats of finish paint.

2.07 INSULATION AND INTERIOR FINISH:

A. ROOF - Refer to Section 07 41 13 Insulated Metal Roof Panel.

PART 3 - EXECUTION

3.01 ERECTION:

A. Erection of metal building, accessories, and insulation shall be performed by one of the following:

1. Authorized systems contractors or builders of the manufacturer.

2. Building manufacturer's crews.

3. Other erectors authorized by the manufacturer as trained and qualified to erect that manufacturer's product. In this case, the manufacturer shall inspect the work and certify its correctness.

END OF SECTION

SECTION 31 10 00 — SITE CLEARING, GRADING AND FILLING

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Clearing, filling and grading of the affected areas of the site.

B. Top Soil removal and reuse.

C. Disposal of debris and surplus materials.

D. Protection of trees and vegetation to remain, coordinate with the Architect.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS:

A. Excation and backfilling for underground site utilities.

B. Paving and sidewalks.

C. Site drainage systems.

1.4 QUALITY ASSURANCE

A. Testing Laboratory Services: Installed materials shall meet specified requirements as determined by the Owner’s Testing Laboratory.

B. Proposed sitework contractor shall be able to provide documentation that he has a minimum of three years of satisfactory experience in the performance of similar operations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Existing top soil to be stockpiled and reused.

B. Existing and off-site earth fill as required.

C. TOPSOIL:

1. Rich sandy loam, low in silt, free of trash, rocks, debris and other foreign materials.
2. Topsoil stripped at the site and stockpiled may be used if material meets the above requirements and quantities are sufficient to meet all topsoil needs of the site. Otherwise topsoil meeting specified requirements and approved by the testing laboratory shall be provided from an approved off site source.

D. FERTILIZER AND GRASSING: Provide grass to replace any disturbed areas during regarding.

PART 3 - EXECUTION

3.1 PROTECTION OF EXISTING TREES AND VEGETATION

A. GENERAL: In addition to any temporary construction fencing provided under Section 01 50 00 Temporary Facilities, provide temporary chain link fencing around existing shrubs, grasses, ground cover and tress indicated to remain. Locate fencing around drip lines of individual trees or groups of trees.

B. REPLACEMENT: Replace damaged existing trees and vegetation indicated to remain with materials of like kind, size and maturity as approved by the architect. Follow supplier's recommended procedures of planting.

3.2 TOPSOIL REMOVAL AND EXCAVATION

A. Strip topsoil to a depth of 4" to 6" under all new site paving, sidewalks, within new building lines and at all site areas which will receive earth fill for grading adjustments.

B. Temporarily store removed topsoil at an on-site location designated by the Architect. Stored topsoil shall be kept free of trash and construction debris.

C. Remove additional existing soil as required to achieve any finish paving grades which may be at or near natural grade elevation.

3.3 EXCAVATING, GRADING AND FILLING

A. GRADE ELEVATIONS: Establish finish grades as indicated on the drawings. Set and maintain grade stakes.

B. ROUGH GRADING:

1. Provide clean earth fill meeting specified requirements from off-site should additional earth fill be required.
2. Provide temporary and permanent drainage swales, pumps, gutters and trenches necessary to dry existing soil and carry off water during construction. As indicated on drawings shape the site around structures to drain away from the building(s) at all times. Do not allow water to stand around trees scheduled to remain.

3. All site fill at unpaved and typical sidewalks areas shall be thoroughly compacted in lifts as specified below. Each layer and subgrade shall be wetted or dried as required to achieve optimum moisture content and then compacted to minimum ninety (90%) percent Proctor density per ASTM D1557. The subgrade shall be thoroughly and completely scarified before wetting and rolling.

C. COMPACTION: Compaction may be obtained by any of the following methods:

1. By sheepsfoot rollers having a unit weight on the contact feet of not less than 300 pounds per square inch with the soil being compacted in layers not exceeding 8" in depth (loose measurement).
2. By pneumatic tired rollers having a minimum compression of 325 pounds per inch of width of tire tread, with the soil being compacted in layers not exceeding 8" in depth (loose measurement).
3. For those portions of fill which cannot be reached with the sheepsfoot roller, such as corners and areas adjacent to columns, beams, etc., mechanical tampers shall be employed to obtain specified compaction.

D. EXISTING UTILITIES:

1. Arrange with utility companies for removal or relocation of any existing utilities.
2. Remove abandoned utilities up to the property line and provide permanent watertight cap.
3. If unknown or uncharted utilities are encountered during excavation, promptly notify the Architect before proceeding. Damage to existing utilities by continuing work without notifying the Architect shall be repaired by the Contractor at no additional cost to the Owner.

E. FINISH GRADING;

1. After rough grading and proof rolling operations are complete, install 2" of topsoil over unpaved open area (within the limits of grading) and fine grade to finish contours and make ready to receive grass planting (whether or not grass planting is required under this contract).
2. Open areas shall be raked smooth and left free of clumps, trash, debris and vegetation. Finish grading shall be uniform in planarity, meeting elevations and slopes as indicated on the drawings, and as required to ensure proper drainage.

3.4 DISPOSAL:

1. Adhere to Federal, State, County and local regulations regarding disposal of removed trees, shrubs, vegetation, soil, and rubble. It is the sole responsibility of the Contractor to determine the regulations regarding on-site burning of removed trees and vegetation.
2. Upon completion of fine grading operations, any excess soil shall be removed from the site, stockpiled at the site, or relocated to any property controlled by the Owner within five miles of the site. The above options shall be as determined by the Owner at no additional cost to the Owner.

END OF SECTION

SECTION 31 31 16 - TERMITE CONTROL

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.2 SECTION REQUIREMENTS

A. Submittals: Product Data and product certificates signed by manufacturer certifying that products used comply with U.S. EPA regulations for termiticides. Include application instructions and EPA-Registered Label.

B. Engage a licensed professional pest control operator to apply termite control solution.

PART 2 - PRODUCTS

2.1 TERMITICIDES

A. Provide an EPA-registered termiticide (5 year) complying with requirements of authorities having jurisdiction, in a soluable or emulsible, concentrated formulation that dilutes with water or foaming agent. Use only soil treatment solutions that are not harmful to plants. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prepare surfaces and apply treatment at rates and concentrations recommended in manufacturer's written instructions.

B. Apply termite control to the following:

1. At foundations. (Piers, mid-span supports)
2. Under sub-floors and flooring materials.

3. Under basement floor slabs.
4. At hollow masonry.
5. At expansion and control joints and slab penetrations.
6. At crawlspaces; treat soil under and adjacent to foundation supports. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment.

C. Post warning signs in areas of application.

D. Reapply soil termiticide treatment solution to areas disturbed by subsequent excavation or other construction activities following application.

END OF SECTION

SECTION 32 11 00 — FLEXIBLE BASE

PART 1 - GENERAL

1.00 COORDINATION

A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.01 GENERAL DESCRIPTION OF WORK:

1. This work shall consist of furnishing and placing a foundation course for surface courses or for other base courses.
2. Flexible base shall be composed of either caliche (argillaceous limestone, calcareous or calcareous clay particles, with or without stone, conglomerate, gravel, sand or other granular materials), crushed stone, gravel, iron, or topsoil, shell, or crushed slag.
3. Flexible base shall be constructed as specified herein in one or more courses in conformance with details, lines and grades shown on the plans, and as established by the ENGINEER.

PART 2 - PRODUCTS

2.01 MATERIALS

1. Materials for flexible base shall be crushed or uncrushed as necessary to comply with the requirements hereinafter specified.
2. Materials shall consist of durable course aggregate particles mixed with approved binding materials.

2.02 LIME STABILIZATION:

1. The material for flexible base shall be lime stabilized.

2.03 TYPES:

1. Type A - Crushed or broken aggregate (excluding gravel aggregate).
2. Type B - Gravel Aggregate
3. Type C - Iron Ore Topsoil
4. Type D - Shell Aggregate with Sand Admixture
5. Type E - Shell Aggregate with Sand and Caliche Ad mixture
6. Type F – Caliche
7. Type G - Crushed Slag
8. Unless otherwise noted on the plans, the CONTRACTOR may use any on type of these types provided the material used meet the requirements set forth in the specification test limits herein.

2.04 GRADES:

1. Unless otherwise shown on the plans or directed by the ENGINEER, the final course of base material shall consist of Grades 1, 2, 3, or 4 as specified in Table 02601-1.
2. Base courses or subbase materials, unless otherwise noted on the plans or directed by the ENGINEER, may consist of Grades 1, 2, 3, or 4 as specified in Table 02601-1.
3. All grades shall, when tested in accordance with standard laboratory test procedures, meet the physical requirements set forth in Table 0260 1 - 1.
4. Testing of flexible base materials shall be in accordance with the following test procedures:

TEST	TESTING PROCEDURE
Preparation for soil constants and sieve analysis	TEX-101-E
Liquid Limit	TEX-104-E
Plastic Limit	TEX-105-E
Plasticity Limit	TEX-106-E
Sieve Analysis	TEX-110-E
Wet Ball Mill	TEX-116-E
Triaxial Test	TEX-117-E (Part I or II)

5. Unless otherwise specified on the plans, samples for testing the material for Soil constants, Graduation and Wet Ball Mill shall be taken prior to the compaction operations.
6. Unless otherwise specified on the plans, samples for triaxial tests shall be taken from the stockpile or from production, as directed by the ENGINEER, where stockpiling is required and from production where stockpiling is not required.

PHYSICAL REQUIREMENTS FOR FLEXIBLE BASE MATERIALS

GRADES				
TYPES	Grade 1:	Grade 2:	Grade 3:	Grade 4:
	(Triaxial class 1 Min. compressive Strength, psi: 45 at 0 psi lateral pressure and 175 at 15 psi lateral pressure	(Triaxial class 1 to 2.3)Min. compress-ive strength, psi: 35 at 0 psi lateral press-ure and 175 at 15 lateral pressure	(Unspecified Triaxial Class)	
TYPE A Crushed or Broken Aggregate (excluding gravel aggregate)	Retained on % Sq. Sieve 1-3/4……...0 7/8”……..10-35 3/8”……..30-50 No. 4……...45-65 No. 40…….70-85 Max LL……35 Max PI……..10 Wet Ball Mill Max Amt……40 in Passing	Retained on % Sq. Sieve 1-3/4”……....0-10 No. 4……..…45-75 No. 40…….....60-85 Max LL……40 Max PI……..12 Wet Ball Mill Max. Amt…….50 Max increase in passing No. 40…….20	Retained on % Sq. Sieve 1-3/4”……....0-10 No. 40…….....60-85 Max LL……45 Max PI……..15 Wet Ball Mill Max. Amt…….55 Max increase in passing No. 40…….20	As Shown On Plans

	No. 40……...20			
TYPE B Gravel Aggregate		Retained on % Sq. Sieve 12-2/4”……..…0-10 No. 4……...30-75 No. 40……..…70-85 Max LL……....35 Max PI……..12	Retained on % Sq. Sieve 1-3/4”…..…...…0-5 No. 4……...30-75 No. 40……..…65-85 Max LL……....35 Max PI……..12	As Shown On Plans
TYPE C Iron Ore Topsoil		Retained on % Sq. Sieve 2-1/2”……..…...…0 No. 40……..…50-85 Max LL……....35 Max PI……..12	Retained on % Sq. Sieve 2-3/4”……..…...…0 No. 40……..…45-85 Max LL……....35 Max PI……..12	As Shown On Plans
TYPE D Sand-Shell		Retained on % Sq. Sieve 1-3/4”……0-10 No. 4……...45-65 No. 40……..…50-70 Max LL……....35 Max PI……..12	Retained on % Sq. Sieve 1-3/4”……..…0 No. 40……..…45-65 Max LL……....35 Max PI……..12	As Shown On Plans
TYPE E Shell with Sand and Caliche		Retained on % Sq. Sieve 1-3/4”……..…0 No. 40……..…45-65 Max LL……....35 Max PI……..10	Retained on % Sq. Sieve 1-3/4”……..…0 No. 40……..…45-65 Max LL……....35 Max PI……..12	As Shown On Plans
TYPE F Caliche		Retained on % Sq. Sieve 1-3/4”……..…0 No. 4……...45-75 No. 40……..…50-85 Max LL……....40 Max PI……..12	Retained on % Sq. Sieve 1-3/4”……..…0 No. 40……..…50-85 Max LL……....40 Max PI……..12	As Shown On Plans
TYPE G Crushed Blast Furn-ance Slag				As Shown On Plans

7. The limits establishing reasonable close conformity with the specified gradation and plasticity index are defined by the following:
    1) The ENGINEER may accept the material, providing not more than 2 of 10 consecutive gradation tests performed are outside the specified limits on any

individual or combination of sieves by no more than 5% and where no two consecutive tests are outside the specified limits.

2) The ENGINEER may accept the material providing not more than 2 of 10 consecutive plasticity index samples tested are outside the specified limit by no more than two points and where no two consecutive tests are outside the specified limit.

2.05 STOCKPILING:

1. When specified on the plans, the material shall be stockpiled prior to delivery on the road. The stockpile shall be not less than the height indicated and shall be made up of layers of material not to exceed the depth shown on the plans.
2. After a sufficient stockpile has been constructed as specified on the plans, the CONTRACTOR may proceed with loading from the stock - pile for delivery to the road.
3. In loading form the stockpile for delivery to the road, the material shall be loaded by making successive vertical cuts through the entire depth of the stockpile.
4. If the CONTRACTOR elects to produce the Type a material from more than one material or more than one source, each material shall be crushed separately and placed in separate stockpiles so that at least 75 percent of the material in the course aggregate stockpiles will be retained on the No. 4 sieve and at least 70 percent of the material in the fine aggregate stockpile will pass the No. 4 sieve.
5. The materials shall be combined in a central mixing plant in the proportions determined by the ENGINEER to produce a uniform mixture which meets all of the requirements of the specification. In the event that combinations of the materials produced fail to meet all of the specification requirements, the CONTRACTOR will be required to secure other materials which will meet specifications requirements.
6. The cental mixing plant shall be either the batch or continuous flow type, and shall be equipped with feeding and metering devices which will add the materials into the mixer in the specified quantities.
7. Mixing shall continue until a uniform mixture is obtained.

PART 3 - EXECUTION

3.01 PREPARATION OF SUBGRADE

1. Type roadbed shall be excavated and shaped in conformity with the typical sections shown on the plans and to the lines and grades as established by the ENGINEER.
2. All unstable or otherwise objectionable material shall be removed from the subgrade and replaced with approved material.
3. All holes, ruts and depressions shall be filled with approved material and, if required, the subgrade shall be thoroughly wetted with water and reshaped and rolled to the extent directed in order to place the subgrade in an acceptable condition to receive the base material.
4. The surface of the subgrade shall be finished to line and grade as established and in conformity with the typical section shown on the plans, and any deviation in excess of 2 inch in cross section and in a length of 16-feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.
5. Sufficient subgrade shall be prepared in advance to insure satisfactory prosecution of the work.
6. Material excavated in the preparation of the subgrade shall be utilized in the construction of adjacent shoulders and slopes or other-wise disposed on as directed, and any additional material required for the completion of the shoulders and slopes shall be secured from sources indicated on plans or as directed by the ENGINEER.

3.02 PLACEMENT OF FIRST COURSE-TYPE A, TYPE B, TYPE C, TYPE F, AND TYPE G MATERIAL:

1. Immediately before placing the base material, the subgrade shall be checked as to conformity with grade and section.

2. The material shall be delivered in approved vehicles of a uniform capacity, and it shall be the charge of the CONTRACTOR that the required amount of specified material shall be delivered in each 100-foot station.

3. Material deposited upon the subgrade shall be spread and shaped the same day.

4. In the event inclement weather or other unforeseen circumstances render impractical the spreading of the material during the first 24-hour period, the material shall be scarified and spread as directed ENGINEER.

5. The material shall be sprinkled, if directed, and shall than be bladed, dragged and shaped to conform to typical sections as shown on plans.

6. All areas and Nests of segregated coarse or fine material shall be corrected to removed and replaced with well graded material, as directed by the ENGINEER.

7. If additional binder is considered desirable or necessary after the material is spread and shaped, it shall be furnished and supplies in the amount directed by the ENGINEER. Such binder material shall be carefully and evenly incorporated with the material in place by scarifying, harrowing, brooming or by other approved methods.

8. The course shall be compacted by method of compaction hereinafter specified as the Ordinary Compaction method or the Density Control method of compaction as indicated on the plans, or as directed by the ENGINEER.

    1. When the Ordinary Compaction method is to be used, the following provisions shall apply:
        1) The course shall be sprinkled as required and rolled as directed until a uniform compaction is secured. Throughout this entire operation, the shape of the course shall be maintained by blading and the surface upon completion shall be smooth and in conformity with the typical sections shown on the plans and to established lines and grades.
        2) In that area on which pavement is to be placed, any deviation in excess of 1/4 inch in cross section in a length of 16-feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping, and recompacting by sprinkling and rolling.
        3) All irregularities, depressions or weal spots which develop shall be corrected immediately by scarifying the areas affected, adding suitable material as required, reshaping and recompacting by sprinkling and rolling.
    2. When the Density Control method of compaction is to be used, the following provisions shall apply:
        1) The course shall be sprinkled as required and compacted to the extent necessary to provide not less than the percent density as hereinafter specified under Density.
        2) In addition to the requirement specified for density, the full depth of the flexible base shown on the plans shall be compacted to the extent necessary to remain firm and stable under construction equipment.
        3) After each section of flexible base is completed, tests as necessary will be made by the ENGINEER. If the material fails to meet the density requirements, it shall be reworked as necessary to meet this requirements.
        4) Throughout this entire operation, the shape of the course shall be maintained blading, and the surface upon completion shall be smooth and in conformity with the typical sections shown on the plans and to established lined and grades.
        5) In that area on which pavement is to be placed, any deviation in excess of 1/4 inch in cross section in a length of 16 feet measured longitudinally shall be corrected by

loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

6) All irregularities, depressions or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding suitable material as required, reshaping and recompacting by sprinkling and rolling.

9. Should the base course, due to any reason or cause, lose the required stability, density or finish before the surfacing is complete, it shall be recompacted and refinished at the sole expense of the CONTRACTOR.
10. Where Type C material is used, the material shall be scarified, thoroughly wetted, mixed, manipulated, and bladed so as to secure a uniformly wetted material, and pulled in over the subgrade in courses and set under the action of blading and rolling. The work of mixing, blading, rolling, shaping and subsequent maintenance shall be performed by the continuous use of sufficient number of satisfactory rollers and power maintainers with adequate scarifier attachments.

3.03 PLACEMENT OF FIRST COURSE – TYPE D MATERIAL:

1. Immediately before placing the base material, the subgrade shall be checked as to conformity with grade and section, and corrections made if necessary.
2. All materials shall be delivered in approved vehicles of a uniform capacity.
3. The required amount of shell shall be uniformly spread across the section and allowed to dry sufficiently to insure proper slaking and mixing of the binder material. Immediately upon completion of the drying period, as determined by the ENGINEER, the specified amount of sand admixture as produce a combined material meeting the requirements hereinbefore specified, shall be spread uniformly across the shell.
4. The material shall then be sprinkled as required and thoroughly mixed by blading and harrowing, or other approved methods.
5. Failure to proceed with the placing of sand admixtures or mixing and placing operations will be grounds for the suspension of placing of shell.
6. Under no condition will the CONTRACTOR be allowed to place an excessive amount of shell without proceeding with the mixing and placing operations.
7. The course shall be compacted by the method of compaction hereinafter specified as the Ordinary Compaction method of the Density Control method of compaction as indicated on the plans, or as directed by the ENGINEER.
    1. When the plans indicate that the Ordinary Compaction method is to be used, the following provisions shall apply:
        1) After mixing, all material shall be windrowed, and then spread over the section in layers.
        2) The layer shall not exceed 2 inches in loose depth.
        3) If necessary to prevent segregation, the material shall be wetted in the window prior to spreading.
        4) After each lift is spread, it shall be sprinkled and rolled to secure maximum compaction as directed by the ENGINEER. Succeeding layers shall then be placed similarly until the course is completed.
        5) All areas and nest of segregated coarse or fine material shall be corrected or removed and replaced with well graded material, as directed by the ENGINEER.
        6) The course shall then be sprinkled as required and rolled as directed until a uniform compaction is secured.
        7) Throughout this entire operation, the shape of the course shall be maintained by blading,; and the surface, upon completion, shall be smooth and in conformity with the typical sections shown on the plans, and to the established lines and grades.
        8) In that area on which pavement is to be place, any deviation in excess of 1/4 inch in cross section in a length of 16-feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

9) All irregularities, depressions or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding suitable material as required, reshaping and recompacting by sprinkling and rolling.

2. When the plans indicate that the Density Control method of compaction is to be used, the compaction method shall be the same as prescribed for Type A, Type B, Type C, Type F and Type G materials.

8. When indicated on the plans or permitted by the ENGINEER, Type D material may be mixed in a central mixing plant and delivered to the road as a combined mixture. When this method is used, the combined mixture shall meet the requirements for Type D material as hereinbefore specified and the placing and compaction requirement shall be the same as prescribed for Type A, Type B, Type C, Type F and Type G material.

3.04 PLACEMENT OF FIRST COURSE-TYPE E MATERIAL

1. The construction methods for placing the first course of Type E material shall be the same as prescribed for Type D material except that after the shell and sand have been placed, the prescribed amount of caliche shall then be spread across the sand and shell.
2. The composite mixture shall than be sprinkled as required and thoroughly mixed by blading and harrowing or other approved methods.
3. Compaction of the first course of Type E material shall be the same as prescribed above for Type D material.
4. Failure to proceed with placing the sand and caliche admixture or mixing and placing operations will be grounds for the suspension of placing the shell.
5. Under no conditions will the CONTRACTOR be allowed to place an excessive amount of shell without proceeding with the mixing and placing operations.

3.05 PLACEMENT OF SUCCEEDING COURSES – ALL MATERIAL TYPES:

1. Construction methods shall be the same as prescribed for the first course.
2. Prior to placing the surfacing on the completed base, the base shall be dry cured to the extent directed by the ENGINEER.

3.06 DENSITY CONTROL:

1. When the Density Control method of compaction is indicated on the plans, each course of flexible base shall be compacted to the percent density shown on the plans.
2. The testing will be as outlined in Test Method Tex- I 14-E.
3. It is the intent of this specification to provide in that part of the base included in the top 8 inches immediately below the finished surface of the roadway not less than 100 percent of the density as determined by the compaction ratio method.
4. Field density determination shall be made in accordance with Test Method Tex115-E.

3.07 TOLERANCES:

1. Flexible base will be measured by the square yard of surface area of completed and accepted work based on the width of flexible base as shown on the plans.
    1. The ENGINEER may accept the work providing not more than 25 percent of the density tests performed each day are outside the specified density by no more than three pounds per cubic foot and where no two consecutive tests on continuous work are outside the specified limits.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

1. Flexible base will be measure by the square yard of surface area of completed and accepted work based on the width of flexible base as shown on the plans.
    1. The flexible base shall be measured for depth by the units of 2000 square yards, with one measurement taken at location selected by the ENGINEER.
    2. In that unit where flexible base is deficient by more than 2 inch in thickness, the deficiency shall be corrected by scarifying, adding material as required, reshaping and recompacting by sprinkling and rolling.
    3. No additional payment over the contract unit price will be made for any flexible base of a thickness exceeding that required by plans.
2. The CONTRACTOR shall schedule his operations in such a manner as to facilitate the measurement of the pay item.
3. The ENGINEER may accept the work provided no more than 2 out of 10 depth tests performed are deficient by not more 2 inch and where no two consecutive tests on continuous work are outside the specified depth.

4.02 PAYMENT:

1. The accepted quantities of flexible base of the type, grade, and compaction method specified will be paid at the contract unit bid price per square yard, complete in place.
2. Where ordinary Compaction is used, all sprinkling, rolling, and manipulation required will not be paid for directly, but will be incidental to other bid items.
3. The unit prices bid shall each be full compensation for shaping and fine grading the roadbed; for securing and furnishing all materials, including all royalty and freight involved, for furnishing scales and labor involved in weighing the material when required; for loosening, blasting, excavating, screening, crushing and temporary stockpiling when required; for loading all materials for all hauling and delivering on the road; for spreading, mixing, blading, dragging, shaping and finishing and for all manipulation, labor, tools, and incidentals necessary to complete the work.

END OF SECTION

SECTION 32 13 13 — CONCRETE PAVING, CURBS AND SIDEWALK

PART 1 - GENERAL

1.1 COORDINATION

A. The General Conditions of the Contract for Construction and the Supplementary Conditions to the General Conditions of the Contract for Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addenda issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the more stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. All site concrete work, including sidewalks, paving, equipment slabs, ramps, and other miscellaneous concrete.

B. All form work.

C. Reinforcing steel.

D. Installation of sleeves provided by plumbing, heating, and electrical contractors for work under site concrete. Sleeves for irrigation system.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Testing Laboratory services.

B. Excavation and fill.

C. Soil stabilization.

1.4 DRAWING REFERENCES: See drawings for reinforcing sizes and placement.

1.5 SUBMITTALS

A. DESIGN MIX: Submit six (6) copies directly to the Owners Testing Laboratory the proposed concrete mix for concrete paving and sidewalks. Include cement brand and type, aggregate identification, admixtures, proportions and anticipated strengths.

B. PLASTIC CHAIR SUPPORT: Submit manufacturer's literature indicating dimensions, configuration, and performance data. Submit sample for approval by the Architect.

C. JOINT FORMS: Submit manufacturer's literature indicating dimensions, configuration, reinforcing and accessories related to load transfer units.

D. ADMIXTURES: Submit manufacturer's literature indicating composition and mix proportions.

E. CURING COMPOUND: Submit manufacturer's literature indicating composition and recommended application procedures.

F. JOINT SEALANT: Submit manufacturer's literature indicating sealant type(s), performance, recommended application procedures, and recommending open or closed cell backer material for the application.

G. DELIVERY TICKETS: Furnish copies of delivery tickets for each load of concrete delivered to the site. Provide items of information as follows:

1. Ambient temperature.
2. Any modifications and dispositions of the load.
3. Driver's identification.
4. Identification of placement location at jobsite.
5. Ingredients by weight.
6. Number of cubic yards.
7. Time emptied.
8. Time loaded.

H. TEST REPORTS: Arrange for the Owner's Testing Laboratory to submit reports to the Owner, Architect and Contractor indicating compressive strength, aggregate type and slump for samples taken at the site.

1.6 SAMPLES

A. Plastic chair support.

B. Minimum 36" x 36" finish samples at the job site for Architects approval. Provide sample for each type of finish (smooth, light broom, medium broom, etc.) and each type of joint.

1.7 WARRANTY

A. Provide written warranty against defects in materials and workmanship for the work under this section for a period of one year after the date of Substantial Completion of the project.

1.8 QUALITY ASSURANCE

A. Cast-in-place concrete shall be installed by technicians specially trained in the proper handling, placing and protection of concrete and reinforcing steel. If required by the Architect, installer shall submit for approval a list of similar installations successfully completed.

B. Cast-in-place concrete shall be mixed and installed in strict accordance with applicable written recommendations and requirements of the Texas State Department of Highways and Public Transportation (TSDHPT) and the American Concrete Association (ACI) including but not necessarily

limited to the following where documents conflict, the most stringent of the requirements as determined by the Architect shall apply:

1. TSDHPT, item 360.
2. ACI 302.
3. Building Code Requirements for Reinforced Concrete, ACI 318.
4. Recommended Practice for Hot Weather Concreting, ACI 305.
5. Recommended Practice for Cold Weather Concreting, ACI 306

PART 2 - PRODUCTS

2.1 MATERIALS

A. GENERAL: All materials used in the Work shall be stored or handled in a manner which will prevent deteriorations; any materials that have been damaged shall be immediately and completely removed from the Work. All manufactured materials, such as cement, shall be delivered and stored in their original packages, plainly marked with the brand and manufacturer's name. Broken packages or packages that show marks or other evidence of damage shall be wholly rejected.

B. CEMENT: Portland cement shall conform to standard specifications of ASTM,C-150, Type l, latest edition. The brand shall be one approved by the Architect, and this one brand shall be used throughout the project.

C. AGGREGATES: Aggregates for concrete of normal weight shall be clean, hard, strong, uncoated, free of loam, fine sand, clay dust, organic or other deleterious matter and shall conform to ASTM C-33.

FINE AGGREGATE			COARSE AGGREGATE		
Sieve Size	Percent Passing	Sieve Size	1-1/2	Percent	3/4
4	95-100	1-1/2	95-100	-	-
16	50- 88	1"	-	90-100	-
50	10-30	3/4"	40-70	-	90-100
100	0- 5	1/2"	-	25- 60	
		3/8"	10-30	-	20-55
		#4	0- 5	0- 10	0- 10

D. Clay - 3% Maximum Clay - 1 % Maximum

E. WATER: Water shall be clean and potable, free from injurious amounts of oil, acid, Alkali, organic matter or other deleterious substances.

F. REINFORCING STEEL: All reinforcing steel shall be high bond, new billet stock, and shall conform with ASTM A-615, except that mesh shall conform with ASTM A-1 85. All materials must be free from seams, flaws, scale or an excessive amount of rust. The supplier shall furnish Architect with a certificate certifying the reinforcing steel is domestic, or supply laboratory tests acceptable to the Architect, that foreign steel meets these tests. Laboratory tests shall be made on each size of steel. Samples for testing shall be taken from jobsite. The samples shall be replaced with bar of like size and length, plus 40 diameter.

G. ANCHORS: Install all necessary anchors, wire loops or other miscellaneous fasteners to be installed in concrete for anchoring masonry or other work.

H. WOOD JOINT FORMS:

1. Sidewalk Joints: Expansion joints at concrete walks shall be 1X Redwood.
2. Paving Joints: 3/4" thick redwood form with minimum 1" deep removable top strip, 3/4" x 1 0" steel reinforcing bars at 24" o.c. with bond-breaker sleeve on one side, and 3/16" thick steel rebar support plates each side. Provide custom size as required for full depth of paving as manufactured by Shepler Equipment Co., or equivalent by Commercial Lumber Supply, Marine Lumber Co., or Southern States Lumber.

I. TRANSIT MIX CONCRETE: Contractor shall provide concrete meeting the specifications with regard to compressive strength, method of handling, and controlled by testing lab at batch plant. Concrete shall meet ASTM C-94; Certificate from supplier shall be furnished to Architect.

J. CURING COMPOUND: Shall be Southform 4-way (cures, seals, dustproofs, and hardens), or equivalent product by Gifford-Hill, Nox-Chem, Sonneborn, or W.R. Grace.

K. ADMIXTURES:

1. General: All admixtures shall be added at the plant during mixing and must be prior approved by the Testing Laboratory. Admixtures shall comply with requirements of ASTM C-260 and C-494. Admixtures containing calcium chloride are not acceptable. **Do not use admixtures in footings or seal slabs.**
2. Water Reducing Agents: All design mixes must test with the required slumps prior to the addition of a water reducing agent. Each specified maximum slump may be increased by a maximum of 2" at the plant by the addition of a maximum of 3 ounces of water reducing agent per 94 pound bag of cement. Meet requirements of ASTM C494, Type F.

    a. "PSI Super" as manufactured by Cormix Construction Chemicals.
    b. "WRDA-1 9" as manufactured by W.R. Grace.
    c. "Sikament" as manufactured by Sika Chemical Corp.

3. Set-Controlling Agents: Under 40 degrees F., add accelerating agent Over 80 degrees F., add retarding agent.

    a. Cormix Construction Chemicals.
    b. Master Builders
    c. Protex Industries
    d. Sika Chemical Corp.

4. Air Entrainment: All structural concrete shall contain an air entraining agent compatible with other approved admixtures. Agent added at the plant shall produce 4-5% air entrainment - not required at drilled footings.

L. REINFORCING BAR SUPPORTS: Heavy-duty type four-legged plastic chair supports with sand plate. Series "G" or "B" (as determined by job conditions) as manufactured by W.H.C. Products, Inc. or approved equivalent by Aztec Concrete Accessories. Provide sand plate for slab on grade. Space at a maximum of 45" centers each way. Provide closer spacing where required to prevent excessive sag, or to support the weight of concrete pump hose.

M. METAL REINFORCEMENT:

1. Bars

   a. General: Detailing conform to ACI detailing manual.
   b. Grade 60: Comply with ASTM A 615.
   c. Grade 40 (#3 bars): Comply with ASTM A 615.

2. Mesh

   a. Comply with ASTM A 185.
   b. Mesh shall be type which is fabricated and delivered in flat sheets.
   c. Use mesh only where specifically indicated in the drawings for sidewalks or equipment pads.

N. PAVING JOINT SEALANT: Polyurethane base, multi-component, chemical curing, self-leveling Type 1, conforming to requirements of FS TT-S-00227E, Class A (provide equivalent non-sagging Type 2 at vertical joints in curbs), as manufactured by Tremco or equivalent by Sonneborn, Sheplers, or Pecora. Use with flat strip, non-absorbent polyethylene joint backer-open or closed cell type as recommended by the sealant manufacturer.

2.2 MIX DESIGNS

A. The concrete mix shall be designed by the concrete supplier and approved by the Owner's Testing Laboratory. Contractor shall furnish to the laboratory samples of the aggregate he proposes to use in the concrete work. Concrete mixes shall achieve twenty eight (28) day compressive strengths indicated below, and shall be so proportioned as to obtain a workable mix in accordance with the following limits:

Compressive Strength	Minimum Cement	Maximum Total
at 28 days	Content 94#	SacksWater Per Sack of Cement
Minimum P.S.I.	Cubic Yard	Gallons
Paving 3,500	5.5	7.0

B. SLUMPS: Slumps greater than specified can adversely affect concrete performance due to excessive shrinkage. Slumps specified below are based upon concrete design mix prior to addition of any approved water reducing agent.

1. 5"+/-1": Sidewalks
2. 3"+/-1": Paving,curbs

C. The use of fly ash in the concrete mix is not acceptable.

D. MIXING

1. Comply with ASTM C 94.

2. Mix concrete to a uniform distribution of materials. Mix at least two minutes after materials are in mixer. Discharge concrete completely before mixer is recharged.
3. Mix each batch not less than 70 or more than 100 revolutions of the drum at mixing speed. Additional mixing is to be done at agitating speed.

E. ADJUSTMENTS TO MIX DESIGN: Submit for approval by the Owner's Testing Laboratory any proposed adjustments to the approved mix design due to job conditions, weather or testing results. Necessary adjustments to the mix design shall be at the Contractor's expense.

PART 3 - EXECUTION

3.1 PREPARATION

A. Any portions of the subgrade or fill that are below optimum moisture content shall be wetted at least one (1) week prior to placing concrete in order to achieve a proper uniform distribution of moisture.

B. All preliminary work shall be carefully checked, all trash and debris removed, and the approval of the Architect obtained before any concrete is placed. The Architect shall be notified twenty-four (24) hours before any concrete is scheduled to be placed.

C. SUBGRADE APPROVAL- The bearing grade of slab-on-grade concrete shall require approval of the Owner's testing laboratory immediately prior to the placement of concrete regardless of any previous test results. Bearing grade which is overly dry, saturated, exhibits standing water, contaminants, irregularities or other properties which may tend to be deleterious to the performance of the cast-in-place concrete will not be approved by the Owner's testing laboratory as suitable for concrete placement.

D. Coordinate and provide for plumbing, electrical, carpentry, masonry, miscellaneous metals and other installation requirements, which must be completed prior to concrete work or which may require special forming or block-outs.

E. CLEANING: Clean all forms of debris and thoroughly wet wood forms before placing concrete.

F. Inspect subgrade to determine that uniform thickness of concrete paving and walks will result in proper drainage and no standing water. Notify Architect prior to beginning work of any no slope areas or potential standing water conditions.

G. HOT WEATHER CONDITIONS: Where ambient temperature exceeds 95 degrees F. with a wind velocity exceeding 5 MPH or temperature exceeds 90 degrees F. with a wind velocity exceeding 15 MPH, follow recommendations in ACI publication "SLABS ON GRADE" to protect against rapid drying.

H. Do not place concrete when air temperature is 40 degrees F. or below or when the air temperature is expected to go below 30 degrees F. in the following 48 hours after placing of concrete unless the concrete is protected from such temperature.

I. Install all anchors, fasteners, junction boxes, curb dowels collection boxes or other construction to be installed within concrete paving.

3.2 INSTALLATION

A. TRANSIT: Concrete shall be agitated continuously with slow revolutions of the drum white in transit. No concrete shall be deposited after being in the mixer more than 90 minutes. Testing laboratory shall

check each delivery ticket and notify Contractor immediately of any concrete arriving more than 90 minutes after plant loading.

B. HANDLING: Concrete shall be deposited in the forms as rapidly as practicable by methods which will prevent loss or separation. It shall be deposited as nearly as practicable in its final position to avoid rehandling. Provide runways, or other means for wheeled equipment to carry concrete to points of deposit.

C. PLACING REINFORCEMENT:

1. A thin film of rust will not be considered objectional, but no loose or scaly rust, dirt, mud or cement will be allowed. Steel must be cleaned with wire brushes or replaced if pitted from rust.
2. Accurately position, secure against displacement with #18 gauge wire ties or suitable clips, support by heavy duty plastic chairs with sand plates. Do not use "brick batts" or rubble for support.
3. Follow recommendations of Concrete Reinforcing Steel Institute as to type of steel, splicing, location and placement.

D. PLACING CONCRETE:

1. Deposit and consolidate concrete in a continuous operation, within the limits of joint forms, until the placing of a panel or section is completed.
2. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement, other embedded items, and into corners.
3. Maintain reinforcing steel in the proper position continuously during concrete placement operations.
4. Bring slab surfaces to the correct plane with a straight edge or vibrating screed and strike off. Use bull floats or derbies to smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.
5. Concrete surface shall be true to plane within 1/4" against a 10' straight edge.

3.3 JOINTS

A. LOAD TRANSFER UNITS:

1. Install wood joint form in accordance with manufacturer's printed directions prior to concrete pour. All plastic sleeves at reinforcing bars shall be placed running in same direction.
2. Install manufacturers stakes at 48" o.c. maximum where concrete is to be placed on both sides of form simultaneously. Install at 36" o.c. maximum at cold joints.
3. Longitudinal joint forms shall be continuous through transverse joint forms.
4. Pre-wet form boards prior to placement to ensure against dry wood forms removing water at edges of concrete.
5. Leave removable top strip in place and protect until sealant operations begin.

B. WOOD FORMS:

1. Install similar to load transfer units. Use at radiused areas and sidewalks.
2. Kerf where required for radius.
3. Leave removable top strip in place at paving and protect until sealant operations begin. Top strip and sealant not required at sidewalks.

C. KEYED JOINTS:

1. Align metal joint forms and install manufacturer's splice clip at ends to keep joints in alignment during concrete placement.
2. Set all stakes securely to keep joint form from moving during concrete placement.
3. Do not remove forms until concrete has obtained sufficient strength. When removing forms, apply no vertical uplift which may damage or weaken concrete key.

3.4 CURBS

A. Provide machine laid (extruded) reinforced concrete curbs unless monolithic or formed curbs are indicated in the drawings.

B. Apply epoxy to cured concrete paving and continuously lay curb over installed dowels.

3.5 FINISHING

A. GENERAL: Concrete finishes shall match approved jobsite samples approved by the Architect. Spreading of dry cement for finishing is not acceptable. Begin finishing operations as soon as water sheen has disappeared from surface.

B. PAVING FINISHES: Slabs shall be true to plane within 1/4" in a length of 10' machine finish and provide light to medium broom finish (across the direction of traffic) at all paving as approved by the Architect.

C. SIDEWALKS: Provide light broom finish perpendicular to walk. Provide Architect with sample panel of proposed finish for approval prior to beginning work.

D. STEPS AND RAMPS: Shall be constructed as detailed. Exterior steps, landings, and ramps shall be medium broom finished.

E. PAVING JOINTS: Provide tooled eased edges along both sides of redwood joint form to ensure neat appearance, sealant adhesion, and to facilitate removal of top strip. Use 1/8" radius jointing tool.

F. OPEN TOOLED JOINT: Provide scored lines on concrete sidewalks 5'-0" o.c. unless spaced otherwise on the drawings. Joint size shall be 1/4" wide x 1/4 depth of concrete.

G. All concrete paving and walks shall be uniform in color and consistent in finish. Remove and replace any areas dimpled by rain or discolored (concrete mix).

3.6 CURING

A. Apply complete covering of curing compound as soon as concrete is finished and in accordance with manufacturer’s instructions. Curing compound shall be applied as it comes from the can, at the rate of 200 to 300 square feet per gallon.

B. To avoid sealant adhesion problems ensure that curing compound does not seep into paving joints that receive sealant.

3.7 CAP SEALANT

A. Remove redwood top strip from joint forms. Take care to avoid damaging concrete edges. Clean sealant cavity and inspect for proper depth as recommended by sealant manufacturer.

B. Ensure that sealant cavity is clean, dry, and free of dust, dirt, and small stones. Ensure that edges are not contaminated with curing compound, oil or other agents, which might cause adhesion failure. Prime side walls in accordance with sealant manufacturer's recommendations.

C. Install flat ethafoam strip in bottom of sealant cavity to provide bond-breaker at bottom of sealant and to ensure against sealant loss past the joint form. Install strip in thickness required to provide sealant cavity size as recommended by sealant manufacturer. Use no sand or other loose material in joint cavity.

D. Mix sealant thoroughly in accordance with manufacturer’s recommendations and pour to within 1/8" of top of paving. Where sealant must be repoured due to run off or improper level, remove completely all traces of sealant on side walls before next application.

E. At concrete curbs rake joint filler to minimum 1" depth and install sealant manufacturer’s vertical joint grade sealant.

3.8 CLEANING AND PROTECTION

A. Paving is to be kept free of any foreign substances (wax, oil, paint, etc.) or surface irregularities, which may affect the final appearance of the completed installation.

B. Unless otherwise approved by the Architect, no vehicular traffic will be allowed on any concrete slab, paving or drive until after the 7 day concrete tests have been made by the laboratory indicating that the concrete has attained 3,000 psi compressive strength.

C. Contractor shall coordinate with Architect and Owner to determine a suitable on-site “wash-out” area for concrete trucks. Contractor shall be responsible for clean up of the designated area.

D. Contractor shall keep clean all adjacent public streets and rights of way. Wash down daily or more often as needed to maintain a safe condition at entrances/exits to site.

3.9 TESTING LABORATORY CONTROL

A. Contractor shall contact Owner's Testing Laboratory at least 24 hours prior to time of anticipated concrete placement.

B. Contractor shall require the manufacturers of the cement and metal reinforcement to be used in the work to furnish mill certificates showing that such materials meet ASTM standards as specified.

C. Contractor shall follow all requirements of ASTM C 31 concerning the proper handling and protection of concrete test cylinders. Contractor shall provide locked storage facilities for test cylinders with all heat, insulation and protection as required by ASTM C 31.

END OF SECTION

SECTION 33 05 00 — SITE DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Conditions of the Contractor for Construction and the Supplementary Conditions to the General Conditions of the Contract for the Construction shall be considered as part of this section of the specifications.

B. Each Bidder shall be responsible for determining during the bidding period the extent that any addendum issued during the bidding period may affect this section of the specifications.

C. Reference Instructions to Bidders for requirements regarding substitutions of materials and products.

D. Where conflicts occur between the drawings and specifications, between different drawings, between different portions of this section of the specifications, or between different sections of the specifications, the stringent requirements and the greater quantity shall apply.

1.2 WORK INCLUDED

A. Provide and install storm sewer piping, collection boxes, grates, manholes, culverts, inlets and headwalls as indicated in the Architectural drawings and specified herein.

B. Related trenching, pipe bedding, backfill, and compaction as indicated in the Civil and MEP documents drawings and specified herein.

C. Trench safety in accordance with OSHA requirements and as specified under Trench Safety Section.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Piping indicated on pluming drawings.

B. Site clearing, grading and filling.

1.4 SUBMITTALS

A. PRODUCT DATA: Submit manufacturer’s literature for piping precast drainage structures and grates illustrating performance, fabrication procedures, materials and sizes.

B. Reference Section 01 33 00 SUBMITTALS for additional submittal requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. CONCRETE SEWER PIPING: Extra strength tongue and groove pipe conforming to ASTM C-76, Class III for reinforced pipe.

B. JOINT SEALS:

1. Under 42" diameter: Provide Talcote Asphalt Primer No. 041 and Talcote Cold Plastic No. 052 joint compound.
2. 42" diameter and larger: Bell and rubber gasketed joints.

C. CONCRETE: Minimum compressive strength of 3,000 psi. Conform to requirements of Cast in Place Concrete Section 3.

D. POLYVINYL CHLORIDE (PVC) SDR 26 PIPING: Provide PVC piping where indicated on the drawings. Jointing shall be solvent weld or bell and gasket meeting requirements of A.S.T.M. 3212. Piping shall meet requirements of A.S.T.M. D-3034.

E. INLETS:

1. Precast concrete, cast in place concrete or brick collection boxes as indicated in the drawings. Brooks Products, or equivalent. Form both inner and outer walls for cast-in-place items.
2. Brick: ASTM C-32 sewer brick, Grade SS, 2-1/4" x 3-3/4" x 8".
3. Gratings, Covers and Frames: Cast iron, McKinley, Neenah or approved equal. Heavy duty in paving. Medium duty in walks. Light duty in grass or planting areas.

PART 3 - EXECUTION

3.1 INSTALLATION

A. INLETS:

1. All storm sewer inlets shall be constructed to the line and grade and at location shown on the drawings. Inlets shall be constructed in strict accordance with details as indicated in the drawings.
2. When the box section of the inlet has been completed, the floor of the inlet shall be shaped by filling with one-two mortar to conform to the section shown on the detail drawings.
3. Cast iron inlet frames and grates shall be accurately adjusted to line, grade and slope and grouted in place with mortar consisting of one part Portland Cement to two parts sand.

B. PIPING:

1. Inspection: Review drawings and job conditions and verify all inverts before trenching to avoid conflict with other below grade utilities either planned or existing. Immediately notify Architect of any apparent conflicts before beginning work.
2. Trenching: Provide trenching in strict compliance with current OSHA regulations and in accordance with Trench Safety Section. Do not trench ahead of pipe laying unless trench is protected.
3. Begin excavation work at the lower end of flow line and proceed to higher flow line. Avoid over-excavating; return over-excavated bed to grade and thoroughly compact. Remove large rocks, foreign or organic material; return bed to grade and thoroughly compact.
4. Lay all pipe on required bedding to a true line slope as indicated in the drawings. Hand excavate at joints to ensure that full length of pipe lays on a solid bed. Install tongue end of pipes facing direction of drainage flow.
5. Bedding and backfilling of pipe:

    a. Bed and backfill all piping in accordance with the details indicated on the drawings. Where local or other applicable codes require more stringent specifications, those codes shall govern.

b. All piping located in County Flood Control District right of way shall be bedded and backfilled with cement stabilized sand in accordance with Flood control District requirements.
c. Cement stabilized sand shall be a homogeneous mixture of 1-1/2 sacks Portland Cement per cu. yd. of mixed material. Provide greater cement content where required by City or County Requirements.

END OF SECTION

SECTION 21 13 13

WET-PIPE SPRINKLER SYSTEMS

1.1 GENERAL

1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install complete wet-pipe fire sprinkler system as specified in Contract Documents.
2. Furnish and install **Firestop Penetration Systems** for fire sprinkler system penetrations as described in Contract Documents.

2 REFERENCES

A. Association Publications:
1. Underwriters Laboratories, Inc.:
   I. UL Directory B, 'Fire Protection Equipment Directory' (2011).

B. Reference Standards:
1. American National Standards Institute / American Society of Mechanical Engineers:
   I. ANSI/ASME B1.20.1-1983(R2006), ‘Pipe Threads, General Purpose (Inch)’.
   II. ANSI/ASME B16.1-2010, ‘Cast Iron Pipe Flanges and Flanged Fittings’.
   III. ANSI/ASME B16.3-2011, ‘Malleable Iron Threaded Fittings: Classes 150 and 300’.
   IV. ANSI/ASME B16.4-2011, ‘Gray Iron Threaded Fittings, Classes 125 and 250’.
   V. ANSI/ASME B16.5-2009, ‘Pipe Flanges and Flanged Fittings’.
2. American National Standards Institute / American Water Works Association:
   I. ANSI/AWWA C606-11, ‘Grooved and Shouldered Joints’.
3. American National Standards Institute / American Welding Society:
   I. ANSI/AWA B2.1/B2.1M-2009, ‘Specification for Welding Procedure and Performance Qualification’.
4. ASTM International:
   I. ASTM A53/A53M-12, ‘Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless’.
   II. ASTM A135/A135M-09, ‘Standard Specification for Electric-Resistance-Welded Steel Pipe’.
   III. ASTM A234/A234M-11a, ‘Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service’.
   IV. ASTM A395/A395M-99(2009), ‘Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures’.
   V. ASTM A536-84(2009), ‘Standard Specification for Ductile Iron Castings’.
   VI. ASTM A795/A795M-08, ‘Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use’.
5. National Fire Protection Association / American National Standards Institute:
   I. NFPA 13: ‘Standard for the Installation of Sprinkler Systems’, (2010 Edition).
   II. NFPA 24: ‘Installation of Private Fire Service Mains and their Appurtenances’, (2010 Edition).
   III. NFPA 25: ‘Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems’, (2011 Edition).
   IV. NFPA 101: ‘Life Safety Code’, (2012 Edition).

3 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   - I. Size sprinkler system piping and sprinklers by one of following methods:
     - a Hydraulic calculation design method based on water supply availability.
   - II. On submittals, refer to sprinkler heads by sprinkler identification or model number published in appropriate agency listing or approval. Trade names and other abbreviated designations are not acceptable.
   - III. Submittal Procedure:
     - a After award of Contract and before purchase of equipment, submit seven sets of shop drawings with specifications and hydraulic calculations to Architect and two sets to local jurisdiction having authority for fire prevention for review.
     - b After integrating Architect's and AHJ's comments into drawings, licensed certified fire protection engineer of record who designed fire protection system shall stamp, sign, and date each sheet of shop drawings and first page of specifications and calculations.
     - c Submit stamped documents to Owner and to AHJ for fire prevention for final approval.
     - d After final approval, submit four copies of approved stamped documents to Architect.
     - e Failure of system to meet requirements of authority having jurisdiction and/or approved stamped construction documents shall be corrected at no additional cost to Owner.

B. Informational Submittals:

1. Qualification Statement:
   - I. Licensed fire protection engineers or fire protection system designer:
     - a Licensed for area of Project.
     - b Certified by NICET to level three minimum.
     - c Provide Qualification documentation if requested by Architect or Owner.
   - II. Installer:
     - a Provide Qualification documentation if requested by Architect or Owner.

C. Closeout Submittals:

1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
   - I. Operations and Maintenance Data:
     - a Maintenance and instructions.
       - List of system components used to indicate name and model of each item.
       - Manufacturer's maintenance instructions for each component installed in Project.
       - Instructions shall include installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance and lubrication instructions.
   - II. Warranty Documentation:
     - a Include copies of required warranties.
   - III. Record Documentation:
     - a Include copies of approved shop drawings.
     - b Provide master index showing items included.
     - c Provide name, address, and phone number of Architect, Architect's Fire Sprinkler Consultant, General Contractor, and Fire Protection subcontractor.
     - d Provide operating instructions to include:
       - General description of fire protection system.
       - Step by step procedure to follow for shutting down system or putting system into operation.

e Provide copy of system's above ground and below ground hydrostatic tests. Provide separate copies for Architect and Owner.
f Provide copy of 'Contractor's Material and Testing Certificate for Above Ground Piping' NFPA 13, Figure 24.1 (2010 edition).

2. Inspection:
I. Provide Owner with latest version of NFPA 25.

D. Maintenance Material Submittals;
1. Extra Stock Materials:
I. Spare sprinkler heads in the quantity recommended by NFPA 13 selected in representative proportion to quantity used in Project and in accordance with NFPA 13 (Six (6) spare sprinkler heads minimum).
II. Provide spare heads in cabinet with sprinkler head wrench for each type of head used. After approval of cabinet and contents, mount cabinet in convenient location in Riser Room.

4 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:
1. Unless noted otherwise, system shall conform to:
I. NFPA 13, 'Light & Ordinary Hazard Occupancies'.
II. NFPA 24, 'Service Mains and Their Appurtenances, Private'.
III. NFPA 25, 'Inspection, Testing, and Maintenance.
IV. NFPA 101, 'Life Safety Code'.
V. Requirements of local water department and local authority having jurisdiction for fire protection.
VI. Underwriters Laboratories Publication, UL Directory B, 'Fire Protection Equipment Directory', current edition at time of Pre-Bid Meeting.
VII. Comply with backflow prevention requirements and, if required, include device in hydraulic calculations.
VIII. Applicable rules, regulations, laws, and ordinances.

B. Qualifications:
1. Licensed fire protection engineer or fire protection system designer certified by NICET to level three minimum and engaged in design of fire protection systems. Engineer / designer shall:
I. Licensed for area of Project.
II. Minimum five (5) years experience in fire protection system installations.
III. Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
IV. Be responsible for overseeing preparation of shop drawings, hydraulic calculations where applicable, and system installation.
V. Make complete inspection of installation.
VI. Provide corrected record drawings to Owner with letter of acceptance.
VII. Certify that installation is in accordance with Contract Documents.
VIII. Upon request, submit documentation.
2. Installer:
I. Licensed for area of Project.
II. Minimum five (5) years experience in fire protection system installations.
III. Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
IV. Upon request, submit documentation.

1.2 PRODUCTS

1 SYSTEM

A. Description:

1. Automatic wet-pipe fire sprinkler system starting at flange in Fire Riser Room and extending throughout the building as shown on the fire sprinkler drawings.

B. Performance:

1. Design Criteria:
   - I. Area of Application and Corresponding Design Density:
     - a Serving Area and Mechanical, Electrical, and Janitorial Areas:
       Ordinary Hazard Group 1.
       Design density = 0.15 gpm per sq ft over 1,500 sq ft (140 sq m).
     - b Storage Areas:
       Ordinary Hazard Group 2.
       Design density = 0.20 gpm per sq ft over 1,500 sq ft (140 sq m).
     - c All Other Areas:
       Light Hazard.
       Design density = 0.10 gpm per sq ft over 1,500 sq ft (140 sq m).
     - d Increase remote areas by 30 percent where ceiling / roof is sloped more than 2 inches (50 mm) per ft.
     - e Remote areas may be reduced within parameters indicated in NFPA 13 for use of quick response sprinklers throughout.
   - II. Maximum Coverage per Sprinkler Head:
     - a Ordinary Hazard Areas: 130 sq ft (12.1 sq meters).
     - b Attic Areas: 120 sq ft (11.2 sq meters).
     - c Light Hazard Areas: 225 sq ft (20.1 sq meters).
   - III. Design Area shall be hydraulically most remote area in accordance with NFPA 13.
     - a Provide a 10 PSI safety allowance under adjusted water flow supply curve.
   - IV. Maximum velocity of water flow within piping: 20 feet (6.1 m) per sec.

C. Components:

1. General: Use only domestically manufactured cast iron pipe fittings, valves, sprinkler heads, and other components.
   - I. Pipe of foreign manufacture that meets ASTM Standards is acceptable.
   - II. Ductile iron fittings of foreign manufacture are acceptable.
2. Pipe:
   - I. Schedule 40 Welded Steel:
     - a Exterior, Above Ground(if applicable): Schedule 40 hot-dip galvanized welded steel meeting requirements of ASTM A53/A53M, ASTM A135/A135M or ASTM A795/A795M.
     - b Interior, Above Ground: Schedule 40 black welded steel meeting requirements of ASTM A53/A53M, ASTM A135/A135M or ASTM A795/A795M.
     - c Connections:
       2 inches (50 mm) And Smaller: Screwed, flanged, or roll grooved coupling system.
       2-1/2 inches (64 mm) And Larger: Flanged or roll grooved coupling system.
3. Fittings:
   - I. Usage:
     - a 2 inches (50 mm) And Smaller: Welded, screwed, flanged, or roll grooved coupling system. For use with schedule 40 carbon steel pipe.

b 2-1/2 inches (64 mm) And Larger: Welded, flanged, or roll grooved coupling system.

II. Types And Quality:

a Screwed:

Cast iron meeting requirements of ANSI B16.4 or ductile iron meeting requirements of ANSI B16.3 and ASTM A536, Grade 65-45-12.
Threaded fittings and pipe shall have threads cut to ANSI B1.20.1.
Do not extend pipe into fittings to reduce waterway.
Ream pipe after cutting to remove burrs and fins.

b Flanged: Steel meeting requirements of ANSI B16.5.

c Welded:

Carbon steel meeting requirements of ASTM A234/A234M.
Weld pipe using methods complying with AWS B2.1, level AR-3. Welding procedures and performance of welders shall comply with AWS B2.1, level AR3.

d Roll Grooved Pipe Coupling System:

Ductile iron meeting requirements of ASTM A395/A395M and ASTM A536, and UL listed.
Grooved products used on Project shall be from same manufacturer.
Grooving tools shall be as recommended by manufacturer of grooved products.
Category Four Approved Products: See Section 01 6200 for definition of Categories:

	Gruvlok	Tyco (Grinnell)	Victaulic
Rigid Couplings	7401	772	Style 005
Flexible Couplings [1]	7000	705	Style 75
Flange Adaptors [2]	7012	71	Style 744
Grooved Coupling Gaskets [3]	'E' EPDM	Grade 'E' EPDM	'E' EPDM [4]

[1] Use in locations where vibration attenuation, stress relief, thermal expansion, or seismic design is required / needed.
[2] Class 125 or 150.
[3] Temperature rated 30 to 150 deg F (minus one to plus 65 deg C). NSF-61 certified.
[4] Grade 'A'.

III. Use of saddle or hole cut type mechanical tees is **NOT APPROVED**.

4. Valves:

I. Butterfly Valves:

a Design Criteria:

UL / CASA approved.
Indicating type.

b Category Four Approved Products: See Section 01 6200 for definitions of Categories:

Milwaukee:
(1) Model BB-SCS02 threaded ends with tamper switch one inch (25 mm) to 2 inches (50 mm).
(2) Model BBVSCS02 Grooved ends with tamper switch 2 inches (50 mm) to 2-1/2 inch (64 mm).
Nibco:
(1) Model WD3510-8 Wafer type with valve tamper switch.
(2) Model GD4765-8N Grooved type with valve tamper switch, 2-1/2 inches (64 mm) to 8 inches (200 mm).
Tyco (Grinnell):
(1) Model BFV-N wafer.

(2) Model BFV-N grooved.
Victaulic: Series 705W Grooved end type with internal supv. switches.
Kennedy:
(1) Model 01W wafer.
(2) Model G300 grooved.

II. Gate Valves:
a Design Criteria:
UL / CASA approved.
Outside Screw and Yoke Type (O.S.&Y).
Class 150 psi.
b Category Four Approved Products: See Section 01 6200 for definitions of Categories:
Nibco:
(1) T-104-0 with Threaded Ends 1/2 inch (12.7 mm) to 2 inches (50 mm).
(2) F-637-31 Flanged Ends.
Mueller: R-2360-6 Flanged Ends.
Victaulic: Series 771 Grooved Ends

III. Ball Valves:
a Design Criteria:
UL / CASA approved.
Valve tamper switch.
b Category Four Approved Products: See Section 01 6200 for definitions of Categories:
Milwaukee: BB-SCS02 with threaded ends.
Nibco: KT-505 with threaded ends.
Nibco: KG-505 with grooved ends.
Victaulic: Series 728 with grooved or threaded ends.

IV. Swing Check Valves:
a 1/2 to 3 inch (13 to 75 mm) horizontal check.
Design Criteria:
(1) Regrinding type.
(2) Renewable disk.
(3) Bronze Class 125 with threaded ends.
Category Four Approved Products: See Section 01 6200 for definitions of Categories:
(1) Nibco: KT-403-W.
(2) Victaulic: Series 712.
(3) Viking: G-1 Grooved ends.
b 2 to 4 inch (50 to 100 mm) Horizontal check:
Design Criteria:
(1) Grooved ends.
(2) Ductile iron body.
(3) Rated 300 psi (2.07 MPa).
Category Four Approved Products: See Section 01 6200 for definitions of Categories:
(1) Tyco (Grinnell): CV-1F Grooved ends.
(2) Victaulic: Series 712.
(3) Viking: G-1 Grooved ends.
c 3 to 12 inch (76 to 300 mm) Horizontal check:
Design Criteria:
(1) Bolted bonnet.
(2) Raised face flanges.
(3) Bronze mounted with ductile iron body.
(4) 125 lb (56.7 kg) Class A.
Category Four Approved Products: See Section 01 6200 for definitions of Categories:

(1) Nibco: F-938-31.
(2) Mueller: A-2120-6.
(3) Viking: F-1 grooved and flanged.

V. Wafer Type Check Valves:
a Design Criteria:
4 to 8 inch (100 to 300 mm) cast iron body.
175 psi (1.21 MPa) minimum working pressure.
Rubber Seat.
b Category Four Approved Products: See Section 01 6200 for definitions of Categories:
Nibco: KW-900-W.
Mueller: A-2102.
Kennedy: Fig.706.

VI. Grooved-End Check Valves:
a Design Criteria:
UL / CASA listed and approved to 250 psi (1.72 MPa) maximum operating pressure.
2-1/2 to 12 inch (64 to 300 mm) ductile iron body.
Disc And Seat:
(1) 2-1/2 And 3 Inch (64 to 75 mm): Aluminum bronze disc with mounted elastomer seal and PPS (polyphenylene sulfide) coated seat.
(2) 4 Inch (100 mm) And Larger: Elastomer encapsulated ductile iron disc with welded in nickel seat.
(3) Viking: Model VK462.
b Category Four Approved Products. See Section 01 6200 for definitions of Categories:
Nibco: KG-900-W grooved ends.
Victaulic: Series 717.
Kennedy: Fig.426.

VII. Alarm Check Valves:
a Category Four Approved Products: See Section 01 6200 for definitions of Categories:
Reliable: E with gauges and drain.
Tyco (Grinnell): Model AV-1-300.
Victaulic: Series 751 with gauges and drain.
Viking: J-1 with gauges and drain.

VIII. Backflow Preventer: Make and model shown on Drawings or as required by local codes.

IX. Retard Chamber:
a Design Criteria:
Self-draining.
b Category Four Approved Products: See Section 01 6200 for definitions of Categories:
Reliable: E-1.
Victaulic: Series 752.
Viking: C-1.

X. Inspector's Test Valve:
a Design Criteria:
Bronze body with threaded or grooved ends.
Combination sight glass / orifice.
b Category Four Approved Products. See Section 01 6200 for definitions of Categories:
Tyco (Grinnell): Model F350.
Victaulic: Testmaster Alarm Test Module Style 720.

5. Sprinkler Heads:

I. Concealed Pendant:
  a Design Criteria:
    Adjustable cover.
    UL / CASA listed and approved.
    Coordinate concealed cover finish with Architect.
  b Type One Acceptable Products:
    Wet Pendant, Flat Profile:
    (1) Reliable: F4FR.
    (2) Victaulic: Model 3802.
    (3) Viking: Model VK462.
    (4) Tyco (Grinnell): Model RF11.
    (5) Equal as approved by Architect before bidding. See Section 01 6200.
    Dry Pendant:
    (1) Flat Profile:
      (a) Tyco (Grinnell): DS-C.
      (b) Victaulic: V3618.
    (2) Equal as approved by Architect before bidding. See Section 01 6200.

II. Horizontal Sidewall Sprinkler:
  a Design Criteria:
    UL / CASA listed and approved.
    Recess adjustable.
    Where guards are required, use chrome plated sprinkler guards that are listed, that are approved by Sprinkler Manufacturer for use with head, and that are supplied by Sprinkler Manufacturer.
  b Type One Acceptable Products:
    Wet System:
    (1) Reliable: F1FR.
    (2) Tyco (Grinnell): Model TY-FRB.
    (3) Victualic: Model V2710.
    (4) Viking: VK305.
    (5) Equal as approved by Architect before bidding. See Section 01 6200.
    Dry System:
    (1) Reliable: F3QR.
    (2) Tyco (Grinnell): DS-1.
    (3) Victualic: Model V3610.
    (4) Viking: VK162.
    (5) Equal as approved by Architect before bidding. See Section 01 6200.

III. Attic Sprinklers, Upright:
  a Design Criteria:
    UL / CASA listed and approved.
    Approved for use in roof structures, combustible and non-combustible, with ceiling below.
  b Category Four Approved Products: See Section 01 6200 for definitions of Categories:
    Tyco: BB, SD, or HIP.

IV. Pendant Sprinklers:
  a Design Criteria:
    UL / CASA listed and approved.
    Where guards or escutcheons are required, use chrome plated sprinkler guards and escutcheons that are listed, that are approved by Sprinkler Manufacturer for use with head, and that are supplied by Sprinkler Manufacturer.

b Type One Acceptable Products:
Reliable: F1FR.
Tyco: TY-FRB.
Victaulic: Model V2704.
Viking: VK302.
Equal as approved by Architect before bidding. See Section 01 6200.

V. Upright Sprinklers:
a Design Criteria:
UL / CASA listed and approved.
b Type One Acceptable Products:
Reliable: F1FR.
Tyco: TY-FRB.
Victaulic: Models V2704.
Viking: VK300.
Equal as approved by Architect before bidding. See Section 01 6200.

6. Water Flow Alarm:
I. Electric Flow Alarm:
a Design Criteria:
UL / CASA listed and approved.
b Category Four Approved Products: See Section 01 6200 for definitions of Categories:
Potter Electric: Horn Strobe, SASH-120, 120VAC.
System Sensor: Horn Strobe, P2RHK-120, 120 VAC.

7. Waterflow Detectors:
I. Electrical Water Flow Switch:
a Design Criteria:
UL / CASA listed.
Switch activates with flow of 10 gpm (37.85 lpm) or more.
Two single pole double throw switches.
Automatic reset.
b Category Four Approved Products: See Section 01 6200 for definitions of Categories:
Potter-Roemer: Model 6201 thru 6208.
System Sensor: WFD20 thru WFD80.
Viking: VSR-F.

8. Tamper Switch
I. Weather and Tamper Resistant Switch.
a Design Criteria:
UL / CASA listed.
Mount to monitor valve and not interfere with operation.
Shall operate in horizontal and vertical position.
b Category Four Approved Products. See Section 01 6200 for definitions of Categories:
Control Valves, Butterfly Valves, Post Indicator Valves:
(1) Potter Electric: Model PCVS.
(2) Notifier: Model PIBV2.
(3) System Sensor: Model PIBV2.
O.S. & Y Valves:
(1) Potter Electric: Model OSYSU.
(2) System sensor: Model OSY2.

9. Automatic Drain Device:
I. Design Criteria:
a Straight Design, 3/4 inch: (19 mm).
II. Category Four Approved Products: See Section 01 6200 for definitions of Categories:
a Nibco: Ball-Drip.

b Potter-Roemer: Figure 5982.
c Viking: B-1.

10. Fire Department Connection: Contractor shall check with local authority having jurisdiction to confirm the type of FDC required.
    I. One Way Inlet with 5" Stortzguard Cap:
        a Class One Quality Standards: See Section 01 6200:
            Round 'AUTO SPKR' identification plate, red enamel finish aluminum plate:
            (1) Croker: Fig 6766.
            (2) Potter-Roemer Fig. 5966.
        b Category Four Approved Products. See Section 01 6200 for definitions of Categories:
            Rough chrome plated:
            (1) Croker: 6405-RC.
            (2) Potter-Roemer: Fig. 5710-C.
            Caps and Chains:
            (1) Croker: 6747 RC.
            (2) Potter-Roemer: 4625.
11. Indicating Post Valve:
    I. Design Criteria:
        a As specified in Section 33 1119: 'Fire Suppression Water Distribution Piping'.
        b Prefer exposed parts non-brass, for theft protection.
        c Supervisory switch.
    II. Category Four Approved Products: See Section 01 6200 for definitions of Categories:
        a As required by Authority Having Jurisdiction (AHJ).
12. Riser Manifold Assembly:
    I. Design Criteria:
        a Groove x Groove Manifold Body.
        b Water Flow Alarm Switch, VSC with Vane, UL / CASA listed and approved.
        c 300 psi (2.07 MPa) Water Pressure Gauge.
        d Test and Drain Valve with Manifold Drain Trim and 1/2 inch (12.7 mm) diameter test Orifice.
        e Pressure Relief Valve, 175 psi (1.21 MPa), non adjustable, pipe discharge to test Drain Valve.
    II. Category Four Approved Products: See Section 01 6200 for definitions of Categories:
        a Tyco: Model 513.
        b Victaulic: Style 747P.

2 ACCESSORIES

A. Manufacturers:
1. Manufacturer Contact List:
    I. Anvil International, Portsmouth, NH www.anvilintl.com.
    II. Cooper B-Line, Highland, IL www.b-line.com.

B. Hangers, Rods, And Clamps:
1. Design Criteria:
    I. Galvanized, unless specified otherwise, and UL / CASA approved for service intended.
2. Class One Quality Standard:
    I. Hangers and accessories shall be Anvil numbers specified or equals by Cooper B-Line.
    II. Pipe Ring Hangers: Equal to Anvil Fig 69.

III. Riser Clamps: Equal to Anvil Fig. 261.

C. Posted System Diagram:
1. Provide single, color-coded floor plan diagram showing total system. Color antifreeze pipe system elements BLUE and wet pipe system elements RED. Indicate locations of antifreeze system drains and sample test station.
2. Include following information on diagram sheet:
   I. Explanation of how to test an antifreeze system.
   II. Step by step shut down procedure.
   III. Step by step system drainage procedure.
   IV. Step by step start-up procedure.
   V. Step by step procedure for protection of system from freezing.
3. Laminate diagram with plastic and mat or frame suitable for hanging near riser.

D. Steel Deck Bracket:
1. Class Two Quality Standard: See Section 01 6200.
   I. Unistrut P1000 with clamp nut, minimum 6 inch (150 mm) length.

1.3 EXECUTION

1 INSTALLERS

A. Acceptable Installers. See Section 01 4301:
1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

2 EXAMINATION

A. Drawings:
1. Fire Protection Drawings show general arrangement of piping. Follow as closely as actual building construction and work of other trades will permit. Install system so it drains.
2. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These Drawings take precedence over Fire Protection Drawings.
3. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions and to enable system to drain.

3 INSTALLATION

A. Interface With Other Work: Provide inserts for attaching hangers in concrete floor construction at time floors are placed.

B. Connect system to flange provided under Section 33 1119. After installation of riser, fill annular space between pipe and slab with flexible mastic.

C. Install sprinkler systems in accordance with requirements of latest editions of NFPA 13 and as specified below:
1. Provide maintenance access to equipment

2. Conceal sprinkler lines installed in occupied areas. In Mezzanine areas, route pipe to side or underneath Mezzanine walkway. Do not impede egress from Attic.
3. Install to enable drainage of system.
   I. Install main drain from riser according to NFPA 13, paragraph 8.17.4.
4. Install piping system, except for dry heads, so it will not be exposed to freezing temperatures.
5. Do not use dropped, damaged, or used sprinkler heads.
6. Install tamper switches and flow detectors where located by Architect.
7. Except for Siamese connection, install automatic ball drip device in lowest point of piping to fire department connection and drain to floor drain or to exterior of building.
8. Brace and support system to meet seismic zone requirements for building site.
9. **Inspector's Test and Drain to be placed in a location approved by the architect.**

D. Flush system at full design flow rate for minimum five minutes. Route water to outside of building. Protect landscaping and other exterior elements from damage during flow tests.

4 FIELD QUALITY CONTROL

A. Field Tests:
1. Pressure Test:
   I. Hydrostatically test system to 200 psi (1.38 MPa) minimum for 2 hours as required by 'Contractor's Material And Testing certificate for Above Ground Piping' NFPA-13.
   II. If system or part of system is to have a glycol solution, hydrostatic test is to be performed using approved glycol solution. Do not hydrostatically test any section of system that is to be filled with a glycol solution with plain water.
2. Water Flow Test:
   I. Test to determine static and residual pressures and corresponding flow rate at point of connection to utility water main.
   II. Adjust water flow test data for seasonal fluctuations and future growth as recommended by Water Utility and AHJ.
   III. At point of connection to utility water main, combine inside and outside hose stream allowances.
3. Check piping in relation to insulation envelope to be certain piping and auxiliary drains are properly enclosed inside building insulation envelope. Report unsatisfactory conditions to Architect.
4. Tests shall be witnessed by Architect and representative of local jurisdiction over fire prevention.

5 CLOSE-OUT ACTIVITIES

A. Instruction of Owner:
1. Instruction Sessions:
   I. Instruct Owner's personnel in operation and maintenance of system utilizing 'Operation And Maintenance Manual' when so doing. Minimum instruction period shall be four (4) hours.
      a Include antifreeze system requirement to be tested at least once a year.
   II. Instruction sessions shall occur after Substantial Completion inspection when system is properly working and before final payment is made.
   III. Provide Owner with latest version of NFPA 25.

B. Training:
1. Installer required to provide FM Training from latest version of NFPA 25 with checklist and brief explanation of following inspections:
   I. Weekly Inspection.

II. Monthly Inspection.
III. Quarterly Inspection.
IV. Semi-Annual Inspection.
V. Annual Inspection.

END OF SECTION

SECTION 22 00 00

SUMMARY OF PLUMBING WORK

PART 1 - GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, as is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.

B. Plumbing Contract Documents were prepared for the Project by:

Trinity MEP Engineering, LLC
3533 Moreland Dr. Ste. A
Weslaco, Texas 78596
Phone Number: (956) 973-0500
Contact Person: Leonardo Munoz, P.E.

C. General Scope of Work:

1. Install systems and equipment as shown on the contract documents. Refer to drawings for schedule of equipment that will be installed. After installing equipment, connect all water, sewer, and/or power to fixtures.
2. Provide all materials and labor associated with a complete operational installation of new systems including, but not limited to:
   - Fixtures for facility
   - Piping for Sanitary Sewer and Vent Systems
   - Piping for Domestic water and Hot Water Systems.

1.2 COORDINATION

A. All plumbing work shall be done under sub-contract to a General Contractor. Plumbing Contractor shall coordinate all work through General Contractor, even in areas where only plumbing work is to take place.

B. Coordination between all trades shall take place on a regular basis to avoid conflicts between disciplines and equipment clearances.

C. Work shall take place with minimal disruption to Owner's operations in areas surrounding the new building.

D. Cooperate fully with other contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

E. Fully coordinate with electrical contractor for providing power to plumbing equipment.

1.3 UTILITIES

1. Coordinate with power, water, telephone, cable and gas utilities to locate all utilities prior to digging in any area.

2. Obtain any approvals required from utilities to relocate utilities.
3. Cost of relocating or bypassing utilities indicated on drawings shall be included in Base Bid.

1.4 CONTRACTOR USE OF PREMISES

A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
   1. Owner Occupancy: Allow for Owner occupancy and use by the public.
   2. Driveways and Entrances: Keep driveways and entrances serving the premises, clear and available to the Owner, the Owner's employees, and emergency vehicles at all time. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:
   1. Temporary fencing around construction areas.
   2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be covered at night and warning lights provided on construction barricades.
   3. Temporary fencing around equipment while site work is in progress.

1.5 SUBMITTALS

1. All equipment and fixtures shall be provided with a submittal.
2. To extradite the submittal process more efficiently, DO NOT piece-meal the submittals. Submit entire plumbing or in a bound enclosure. This will eliminate delays in the submittal process.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Common requirements and procedures for plumbing systems.
   2. Responsibility for proper operation of electrically powered equipment furnished under this Division.
   3. Furnish and install sealants relating to installation of systems installed under this Division.
   4. Furnish and install Firestop Penetration Systems for plumbing systems penetrations as described in Contract Documents.

B. Products Furnished But Not Installed Under This Section:
   1. Sleeves, inserts, supports, and equipment for plumbing systems installed under other Sections.

1.2 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's catalog data for each manufactured item.
         1) Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
         2) Include name, address, and phone number of each supplier.

B. Informational Submittals:
   1. Qualification Statement:
      a. Plumbing Subcontractor:
         1) Provide Qualification documentation if requested by Architect or Owner.
      b. Installer:
         1) Provide Qualification documentation if requested by Architect or Owner.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data (Modify and add to requirements of Section 01 7800):
         1) At beginning of PLUMBING section of Operations And Maintenance Manual, provide master index showing items included:
            a) Provide name, address, and phone number of Architect, Architect's Mechanical Engineer, General Contractor, and Plumbing subcontractor.
            b) Identify maintenance instructions by using same equipment identification used in Contract Drawings. Maintenance instructions shall include:

(1) List of plumbing equipment used indicating name, model, serial number, and nameplate data of each item together with number and name associated with each system item.

(2) Manufacturer's maintenance instructions for each piece of plumbing equipment installed in Project. Instructions shall include name of vendor, installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance instructions.

c) Provide operating instructions to include:

(1) General description of fire protection system.

(2) Step by step procedure to follow for shutting down system or putting system into operation.

b. Warranty Documentation:

1) Include copies of warranties required in individual Sections of Division 22.

1.3 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:

1. Perform work in accordance with applicable provisions of Plumbing Codes applicable to Project. Provide materials and labor necessary to comply with rules, regulations, and ordinances.
2. In case of differences between building codes, laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Notify Architect in writing of such differences before performing work affected by such differences.
3. Identification:
   a. Motor and equipment name plates as well as applicable UL / ULC and AGA / CGA labels shall be in place when Project is turned over to Owner.

B. Qualifications.

1. Plumbing Subcontractor:
   a. Company specializing in performing work of this section.
      1) Minimum five (5) years experience in plumbing installations.
      2) Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
   b. Upon request, submit documentation.
2. Installer:
   a. Licensed for area of Project.
   b. Designate one (1) individual as project foremen who shall be on site at all times during installation and experienced with installation procedures required for this project.
   c. Upon request, submit documentation.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:

1. Accept valves on site in shipping containers with labeling in place.
2. Provide temporary protective coating on cast iron and steel valves.
3. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Storage And Handling Requirements:

1. In addition to requirements specified within, stored material shall be readily accessible for inspection by Architect/engineer until installed.

2. Store items subject to moisture damage in dry, heated spaces.

1.5 WARRANTY

A. Manufacturer Warranty:
   1. Provide certificates of warranty for each piece of equipment made out in favor of Owner.
B. Special Warranty:
   1. Guarantee plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.
   2. If plumbing sub-contractor with offices located more than 150 miles (240 km) from Project site is used, provide service / warranty work agreement for warranty period with local plumbing sub-contractor approved by Architect. Include copy of service / warranty agreement in warranty section of Operation And Maintenance Manual.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Components shall bear Manufacturer's name and trade name. Equipment and materials of same general type shall be of same make throughout work to provide uniform appearance, operation, and maintenance.
B. Pipe And Pipe Fittings:
   1. Weld-O-Let and Screw-O-Let fittings are acceptable.
   2. Use domestic made pipe and pipe fittings on Project, except non-domestic made cast iron pipe and fittings by MATCO-NORCA are acceptable.
C. Sleeves:
   1. General:
      a. Two sizes larger than bare pipe or insulation on insulated pipe.
   2. In Concrete And Masonry:
      a. Sleeves through outside walls, interior shear walls, and footings shall be schedule 80 black steel pipe with welded plate.
   3. In Framing And Suspended Floor Slabs:
      a. Standard weight galvanized iron pipe, Schedule 40 PVC, or 14 ga (2 mm) galvanized sheet metal.
D. Valves:
   1. Valves of same type shall be of same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Acceptable Installers:

3.2 Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

3.3 EXAMINATION

A. Drawings:
   1. Plumbing Drawings show general arrangement of piping, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
   2. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Plumbing Drawings.

3. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

B. Verification Of Conditions:
1. Examine premises to understand conditions that may affect performance of work of this Division before submitting proposals for this work. Examine adjoining work on which plumbing work is dependent for efficiency and report work that requires correction.
2. Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.
3. Check that slots and openings provided under other Divisions through floors, walls, ceilings, and roofs are properly located. Perform cutting and patching caused by neglecting to coordinate with Divisions providing slots and openings at no additional cost to Owner.

3.4 No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

3.5 PREPARATION

A. Demolition Requirements:

B. Changes Due To Equipment Selection:
1. Where equipment specified or otherwise approved requires different arrangement or connections from that shown in Contract Documents, submit drawings showing proposed installations.
2. If proposed changes are approved, install equipment to operate properly and in harmony with intent of Contract Documents. Make incidental changes in piping, ductwork, supports, installation, wiring, heaters, panelboards, and as otherwise necessary.
3. Provide additional motors, valves, controllers, fittings, and other equipment required for proper operation of systems resulting from selection of equipment.
4. Be responsible for proper location of rough-in and connections provided under other Divisions.

3.6 INSTALLATION

A. Interface With Other Work:
1. Furnish exact location of electrical connections and complete information on motor controls to installer of electrical system.
2. Furnish sleeves, inserts, supports, and equipment that are to be installed by others in sufficient time to be incorporated into construction as work proceeds. Locate these items and confirm that they are properly installed.
3. Furnish inserts for attaching hangers that are to be cast in concrete floor construction at time floors are poured.

B. Cut carefully to minimize necessity for repairs to previously installed or existing work. Do not cut beams, columns, or trusses.

C. Locating Equipment:
1. Arrange pipes and equipment to permit ready access to valves, cocks, unions, traps, and to clear openings of doors and access panels.

2. Adjust locations of pipes, equipment, and fixtures to accommodate work to interferences anticipated and encountered.
3. Install plumbing work to permit removal of equipment and parts of equipment requiring periodic replacement or maintenance without damage to or interference with other parts of equipment or structure.
4. Determine exact route and location of each pipe before fabrication.
   a. Right-Of-Way:
      1) Lines that pitch shall have right-of-way over those that do not pitch. For example, plumbing drains shall normally have right-of-way.
      2) Lines whose elevations cannot be changed shall have right-of-way over lines whose elevations can be changed.
   b. Offsets, Transitions, and Changes in Direction:
      1) Make offsets, transitions, and changes in direction in pipes as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.
      2) Furnish and install all traps, air vents, sanitary vents, and devices as required to effect these offsets, transitions, and changes in direction.

D. Penetration Firestops:
   1. Install Penetration Firestop System appropriate for penetration at plumbing systems penetrations through walls, ceilings, roofs, and top plates of walls.

E. Sealants:
   1. Seal openings through building exterior caused by penetrations of elements of plumbing systems.
   2. Furnish and install acoustical sealant to seal penetrations through acoustically insulated walls and ceilings.

F. Furnish and install complete system of piping, valved as indicated or as necessary to completely control entire apparatus:
   1. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper installation of plumbing systems.
   2. Arrange piping to not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings:
      a. Arrange so as to facilitate removal of tube bundles.
      b. Provide accessible flanges or ground joint unions, as applicable for type of piping specified, at connections to equipment and on bypasses.
         1) Make connections of dissimilar metals with di-electric unions.
         2) Install valves and unions ahead of traps and strainers. Provide unions on both sides of traps.
      c. Do not use reducing bushings, bull head tees, close nipples, or running couplings. Street elbows are allowed only on potable water pipe 3/4 inch (19 mm) in diameter and smaller.
      d. Install piping systems so they may be easily drained
      e. Install piping to insure noiseless circulation.
      f. Place valves and specialties to permit easy operation and access. Valves shall be regulated, packed, and glands adjusted at completion of work before final acceptance.
   3. Do not install piping in shear walls.
   4. Cut piping accurately to measurements established at site. Remove burr and cutting slag from pipes.

5. Work piping into place without springing or forcing. Make piping connections to pumps and other equipment without strain at piping connection. Remove bolts in flanged connections or disconnect piping to demonstrate that piping has been so connected, if requested.
6. Make changes in direction with proper fittings.
7. Expansion of Thermoplastic Pipe:
   a. Provide for expansion in every 30 feet of straight run.
   b. Provide 12 inch offset below roof line in each vent line penetrating roof.
8. Expansion of PEX Pipe: Allow for expansion and contraction of PEX pipe as recommended by Pipe Manufacturer.

G. Sleeves:
1. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete slabs on grade (unless noted on plans).
2. Provide sleeves around pipes passing through concrete or masonry floors, walls, partitions, or structural members. Seal sleeves with specified sealants. Follow Pipe Manufacturer's recommendations for PEX pipe (if used) penetrations through studs and floor slabs.
3. Sleeves through floors shall extend 1/4 inch above floor finish in mechanical equipment rooms above basement floor. In other rooms, sleeves shall be flush with floor.
4. Sleeves through floors and foundation walls shall be watertight.

H. Escutcheons:
1. Provide spring clamp plates where pipes run through walls, floors, or ceilings and are exposed in finished locations of building. Plates shall be chrome plated heavy brass of plain pattern and shall be set tight on pipe and to building surface.

3.7 REPAIR / RESTORATION

A. Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it:
1. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown.
2. Surface finishes shall exactly match existing finishes of same materials.

3.8 FIELD QUALITY CONTROL

A. Field Tests:
1. Perform tests on plumbing piping systems. Furnish devices required for testing purposes.

B. Non-Conforming Work:
1. Replace material or workmanship proven defective with sound material at no additional cost to Owner.
2. Repeat tests on new material, if requested.

3.9 CLEANING

A. Remove dirt, grease, and other foreign matter from each length of piping before installation:
1. After each section of piping used for movement of water or steam is installed, flush with clean water, except where specified otherwise.
2. Arrange temporary flushing connections for each section of piping and arrange for flushing total piping system.
3. Provide temporary cross connections and water supply for flushing and drainage and remove after completion of work.

B. Clean exposed piping, equipment, and fixtures. Remove stickers from fixtures and adjust flush valves.

3.10 CLOSEOUT ACTIVITIES

A. Instruction of Owner:
   1. Instruct building maintenance personnel in operation and maintenance of plumbing systems utilizing Operation And Maintenance Manual when so doing.
   2. Conduct instruction period after Substantial Completion inspection when systems are properly working and before final payment is made.

3.11 PROTECTION

A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system. Cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of system. Do not use plugs of rags, wool, cotton waste, or similar materials.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Common hanger and support requirements and procedures for plumbing systems.

B. Products Installed But Not Furnished Under This Section:
1. Paint identification for gas piping used in HVAC equipment.

1.2 SUBMITTALS

A. Action Submittals:
1. Product Data:
a. Manufacturer's catalog data for each manufactured item.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
1. Manufacturer Contact List:
a. Anvil International,
b. Cooper B-Line,
c. Unistrut, Wayne,

B. Materials:
1. Hangers, Rods, And Inserts
a. Galvanized and UL approved for service intended.
b. Support horizontal piping from hangers or on roller assemblies with channel supports, except where trapeze type hangers are explicitly shown on Drawings. Hangers shall have double nuts.
1) Support insulated pipes 2 inches in diameter and smaller with adjustable swivel ring hanger with insulation protection shield. Gauge and length of shield shall be in accordance with Anvil design data.
2) Type Two Acceptable Products:
(1) Swivel Ring Hanger: Anvil Fig. 69.
(2) Insulation Protection Shield: Anvil Fig. 167.
(3) Equals by Cooper B-Line.
3) Support insulated pipes 2-1/2 inches in diameter and larger with clevis hanger or roller assembly with an insulation protection shield. Gauge and length of shield shall be according to Anvil design data.
a) Type Two Acceptable Products:
(1) Clevis Hanger: Anvil Fig. 260.
(2) Roller Assembly: Anvil Fig. 171.
(3) Insulation Protection Shield: Anvil Fig. 167.
(4) Equals by Cooper B-Line.
4) Support uninsulated copper pipe 2 inches in diameter and smaller from swivel ring hanger, copper plated and otherwise fully suitable for use with copper tubing. Support non-copper uninsulated pipes from swivel ring hanger.
a) Type Two Acceptable Products:
(1) Swivel Ring Hanger For Copper Pipe: Anvil Fig. CT-69.
(2) Swivel Ring Hanger For Other Pipe: Anvil Fig. 69.

(3) Equals by Cooper B-Line.

5) Support uninsulated copper pipe 2-1/2 inches in diameter and larger from clevis hanger, copper plated hangers and otherwise fully suitable for use with copper tubing. Support non-copper uninsulated pipes from clevis hanger.
   a) Type Two Acceptable Products:
      (1) Clevis Hanger For Copper Pipe: Anvil Fig. CT-65.
      (2) Clevis Hanger For Other Pipe: Anvil Fig. 260.
      (3) Equals by Cooper B-Line.

c. Support rods for single pipe shall be in accordance with following table:

Rod Diameter	Pipe Size
3/8 inch	2 inches and smaller
1/2 inch	2-1/2 to 3-1/2 inches
5/8 inch	4 to 5 inches
3/4 inch	6 inches
7/8 inch	8 to 12 inches

d. Support rods for multiple pipe supported on steel angle trapeze hangers shall be in accordance with following table:

Rods		Number of Pipes per Hanger for Each Pipe Size						
Number	Diameter	2 Inch	2.5 Inch	3 Inch	4 Inch	5 Inch	6 Inch	8 Inch
2	3/8 Inch	Two	0	0	0	0	0	0
2	1/2 Inch	Three	Three	Two	0	0	0	0
2	5/8 Inch	Six	Four	Three	Two	0	0	0
2	5/8 Inch	Nine	Seven	Five	Three	Two	Two	0
2	5/8 Inch	Twelve	Nine	Seven	Five	Three	Two	Two

1) Size trapeze angles so bending stress is less than 10,000 psi

e. Riser Clamps For Vertical Piping:
   1) Type Two Acceptable Products:
      a) Anvil Fig. 261.
      b) Equals by Cooper B-Line.

f. Concrete Inserts:
   1) Individual Inserts:
      a) Suitable for special nuts size 3/8 inch through 7/8 inch with yoke to receive concrete reinforcing rods, and with malleable iron lugs for attaching to forms.
      b) Type Two Acceptable Products:
         (1) Anvil Fig. 282.
         (2) Equals by Cooper B-Line.

2) Continuous Inserts:
a) Class Two Quality Standard: Equal to Unistrut P-3200 series.

g. Steel Deck Bracket:
1) Class Two Quality Standard: Equal to Unistrut P1000 with clamp nut, minimum 6 inch length.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Interface With Other Work: If project contains concrete structural system.
1. Furnish inserts for attaching hangers that are to be cast in concrete floor construction at time floors are poured.

B. Piping:
1. Properly support piping and make adequate provisions for expansion, contraction, slope, and anchorage.
a. Except for underground pipe, suspend piping from roof trusses or clamp to vertical walls using Unistrut and clamps. Do not hang pipe from other pipe, equipment, or ductwork. Laying of piping on any building element is not allowed.
b. Supports For Horizontal Piping:
1) Support metal piping at 96 inches on center maximum for pipe 1-1/4 inches or larger and 72 inches on center maximum for pipe 1-1/8 inch or less.
2) Support thermoplastic pipe at 48 inches on center maximum.
3) Support PEX pipe at 32 inches minimum on center.
4) Provide support at each elbow. Install additional support as required.
c. Supports for Vertical Piping:
1) Place riser clamps at each floor or ceiling level.
2) Securely support clamps by structural members, which in turn are supported directly from building structure.
3) Provide clamps as necessary to brace pipe to wall.
d. If Structural concrete systems are used: Install supports from inserts cast into concrete floor system, including concrete joists and floor slabs. Where inserts cannot be used, provide expansion shields and support hangers from angles held in place by expansion bolts, never directly from expansion bolt itself. Provide calculations necessary to determine number of expansion bolts required to equal capacity of cast-in-place insert.
e. Attach Unistrut to structural steel roof supporting structure. Spacing and support as described above.
f. Insulate hangers for copper pipe from piping by means of at least two layers of Scotch 33 plastic tape.
2. Gas piping Identification:
a. Apply paint identification for gas piping used with HVAC equipment as specified in Section 23 0553.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
1. Furnish and install identification of plumbing piping and equipment as described in Contract Documents.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Materials:
1. Labels:
a. Equipment Identification:
1) Black formica, with white reveal when engraved.
2) Lettering to be 3/16 inch high minimum.
2. Paint:
a. One Coat Primer:
1) 6-2 Quick Drying Latex Primer Sealer over fabric covers.
2) 6-205 Metal Primer under dark color paint.
3) 6-6 Metal Primer under light color paint.
b. Finish Coats: Two coats 53 Line Acrylic Enamel.
c. Type Two Acceptable Products.
1) Paint of equal quality from following Manufacturers may be submitted for Architect's approval before use. Maintain specified colors, shades, and contrasts.
a) Benjamin Moore,
b) ICI Dulux,
c) Sherwin Williams,

PART 3 - EXECUTION

3.1 APPLICATION

A. Labels:
1. Identify following items with specified labels fastened to equipment with screws (unless noted otherwise):
2. Water Heaters.
3. Engrave following data from Equipment Schedules on Drawings onto labels:
a. Equipment mark.
b. Room(s) served.
c. Panel and breaker from which unit is powered.

B. Painting:
1. Only painted legends, directional arrows, and color bands are acceptable.
2. Locate identifying legends, directional arrows, and color bands at following points on exposed piping of each piping system:
a. Adjacent to each item of equipment.
b. At point of entry and exit where piping goes through wall.

c. On each riser and junction.
d. Every 25 feet on long continuous lines.
e. Stenciled symbols shall be one inch high and black.

3.2 ATTACHMENTS

A. Schedules:

1. Pipe Identification Schedule:

a. Apply stenciled symbols as follows:

Pipe Use	Abbreviation
Domestic Cold Water	CW
Domestic Hot Water	HW

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART1- GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:

1. Furnish and install insulation on hot and cold water lines, fittings, valves, and accessories as described in Contract Documents.
2. Furnish and install insulation on roof drain piping as described in Contract Documents.

B. Related Requirements:

1. Section 22 1116: 'Domestic Water Piping'.
2. Section 22 1400: 'Facility Storm Drainage'.(if provided on plans)

1.2 SUBMITTALS

A. Informational Submittals:

1. Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

Service Water Temperature	Pipe Sizes		
	Up to 1-1/4 In	1-1/2 to 2 In	Over 2 In
170 - 180 Deg F	One In	1-1/2 In	2 In
140 - 160 Deg F	1/2 In	One In	1-1/2 In
45 - 130 Deg F	1/2 In	1/2 In	One In

1.5 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified Section "Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for insulation application.

C. Coordinate installation and testing of steam or electric heat tracing.

1.6 SCHEDULING

A. Schedule insulation application after testing piping systems and, where required, after installing and testing heat-trace tape. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Manufacturers:

1. Manufacturer Contact List:
   a. Armacell, Mebane, NC www.armaflex.com.
   b. Childers Products Co, Eastlake, OH www.fosterproducts.com.
   c. IMCOA, Youngsville, NC www.nomacokflex.com.
   d. Johns-Manville, Denver, CO www.jm.com.
   e. Knauf, Shelbyville, IN www.knauffiberglass.com.
   f. Manson, Brossard, PQ, Canada www.isolationmanson.com.
   g. Nomaco Inc, Yopungsville, NC www.nomacokflex.com.
   h. Owens-Corning, Toledo, OH www.owenscorning.com.
   i. Speedline Corp, Solon, OH www.speedlinepvc.com.
   j. CertainTeed Manson.
   k. Knauf FiberGlass GmbH.
   l. Owens-Corning Fiberglas Corp.
   m. Schuller International, Inc.
   n. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
   o. Armstrong World Industries, Inc.
   p. Rubatex Corp.

B. Materials:

1. Above Grade Metal Piping:
   a. Insulation For Piping:
      1) Snap-on glass fiber or melamine foam pipe insulation, or heavy density pipe insulation with factory vapor jacket.
      2) Insulation Thickness:
      3) Performance Standards: Fiberglas ASJ by Owens-Corning.
      4) Type One Acceptable Manufacturers:
         a) Childers Products.
         b) Knauf.
         c) Manson.
         d) Owens-Corning.
         e) Johns-Manville.
         f) Equal as approved by Architect before bidding. See Section 01 6200.
   b. Fitting, Valve, And Accessory Covers:
      1) PVC.
      2) Performance Standard: Zeston by Johns-Manville.

3) Type One Acceptable Manufacturers:
    a) Knauf.
    b) Speedline.
    c) Johns-Manville.
    d) Equal as approved by Architect before bidding. See Section 01 6200.

2. Below Grade Metal Piping:
    a. Insulation:
        1) 1/2 inch (13 mm) thick.
        2) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
            a) SS Tubolit by Armacell.
            b) ImcoLock by Imcoa.
            c) Nomalock or Therma-Cel by Nomaco.
    b. Joint Sealant:
        1) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
            a) Armacell 520.
            b) Nomaco K-Flex R-373.
3. Pex Piping, Above And Below Grade:
    a. Insulation:
        1) 1/2 inch (13 mm) thick.
        2) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
            a) SS Tubolit
            b) by Armacell.
            c) ImcoLock by Imcoa.
            d) Nomalock or Therma-Cel by Nomaco.
    b. Joint Sealant:
        1) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
            a) Armacell 520.
            b) Nomaco K-Flex R-373.
            c)
4. PP-R Piping, Above And Below Grade:
    a. Insulation:
        1) 1/2 inch (13 mm) thick.
        2) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
            a) SS Tubolit by Armacell.
            b) ImcoLock by Imcoa.
            c) Nomalock or Therma-Cel by Nomaco.
    b. Joint Sealant:
        1) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
            a) Armacell 520.
            b) Nomaco K-Flex R-373.
5. PVC or ABS Piping, Above And Below Grade - Facility Storm Drain:
    a. Insulation:
        1) 1/2 inch (13 mm) thick.

2) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
    a) SS Tubolit by Armacell.
    b) ImcoLock by Imcoa.
    c) Nomalock or Therma-Cel by Nomaco.

b. Joint Sealant:
    1) Category Four Acceptable Products. See Section 01 6200 for definition of Categories:
        a) Armacell 520.
        b) Nomaco K-Flex R-373.

PART 3 - EXECUTION

3.1 APPLICATION

A. Above Grade Piping:
1. Apply insulation to clean, dry piping with joints tightly butted.
2. Install insulation in manner to facilitate removal for repairs. Place sections or blocks so least possible damage to insulation will result from inspection or repairs of piping or equipment.
3. Piping up to 1-1/4 inch Diameter:
    a. Adhere 'factory applied vapor barrier jacket lap' smoothly and securely at longitudinal laps with white vapor barrier adhesive.
    b. Adhere 3 inch wide self-sealing butt joint strips over end joints.
4. Piping 1-1/2 inches Diameter And Larger:
    a. Use broken-joint construction in application of two-layer covering.
    b. Fill cracks and depressions with insulating cement mixed to thick plastic paste.
        1) Apply by hand in several layers to make up total specified thickness.
        2) Final layer shall have smooth uniform finish before application of covering.
5. Fittings, Valves, And Accessories:
    a. Do not apply insulation over flanged joints or victaulic couplings until piping has been brought up to operating temperature and flange bolts have been fully tightened. Insulate valves so wheel, stem, and packing nut are exposed.
    b. Insulate with same type and thickness of insulation as pipe, with ends of insulation tucked snugly into throat of fitting and edges adjacent to pipe insulation tufted and tucked in.
    c. Piping Up To 1-1/4 Inch Diameter:
        1) Cover insulation with one piece fitting cover secured by stapling or taping ends to adjacent pipe covering.
        2) Alternate Method:
            a) Insulate fittings, valves, and accessories with one inch of insulating cement and vapor seal with two 1/8 inch wet coats of vapor barrier mastic reinforced with glass fabric extending 2 inches onto adjacent insulation.
    d. Piping 1-1/2 inches To 2 Inches :
        1) Insulate with hydraulic setting insulating cement or equal, to thickness equal to adjoining pipe insulation.
        2) Apply final coat of fitting mastic over insulating cement.
    e. Piping 2-1/2 inch And Larger:
            1) Insulate with segments of molded insulation securely wired in place and coated with skim coat of insulating cement.

2) Apply fitting mastic, fitting tape and finish with final coat of fitting mastic.

6. Pipe Hangers:
   a. Do not allow pipes to come in contact with hangers.
   b. Pipe Shield:
      1) Provide schedule 40 PVC by 6 inch ong at each clevis and/or unistrut type hanger.
      2) Provide 16 ga by 6 inch long galvanized shields at each pipe hanger to protect pipe insulation from crushing by clevis hanger.
      3) Provide 22 ga by 6 inch long galvanized shield at each pipe hanger to protect insulation from crushing by Unistrut type hanger.
   c. At Pipe Hangers:
      1) Provide rigid calcium silicate insulation (100 psi compressive strength) at least 2 inches beyond shield.
7. Protect insulation wherever leak from valve stem or other source might drip on insulated surface, with aluminum cover or shield rolled up at edges and sufficiently large in area and of shape that dripping will not splash on surrounding insulation.

B. Below Grade Piping:
   1. Slip underground pipe insulation onto pipe and seal butt joints.
   2. Where slip-on technique is not possible, slit insulation, apply to pipe, and seal seams and joints.

3.2 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.4 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.
C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.
E. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
F. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
G. Keep insulation materials dry during application and finishing.
H. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
I. Apply insulation with the least number of joints practical.
J. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

K. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.
   1. Apply insulation continuously through hangers and around anchor attachments. Insulation around hanger or pipe clamp will not be acceptable.
   2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
   3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

L. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

M. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

N. Apply insulation with integral jackets as follows:
   1. Pull jacket tight and smooth.
   2. Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.
   3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.
      a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
   4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
   5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

O. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
   1. Seal penetrations with vapor-retarder mastic.
   2. Apply insulation for exterior applications tightly joined to interior insulation ends.
   3. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
   4. Seal metal jacket to roof flashing with vapor-retarder mastic.

P. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.

Q. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

R. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.
   1. Firestopping and fire-resistive joint sealers are specified in Section "Firestopping."

3.5 MINERAL-FIBER INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet (4.5 to 6 m) to form a vapor retarder between pipe insulation segments.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

3.6 Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

B. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.

C. Apply insulation to valves and specialties as follows:

1. Apply premolded segments of cellular-glass insulation or glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
2. Apply insulation to flanges as specified for flange insulation application.
3. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
4. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.7 CLOSED-CELL PHENOLIC-FOAM INSUALTION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches o.c.

4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:
   1. Apply preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of the same thickness as pipe insulation.
   4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:
   1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturers written instructions.
   2. When premolded sections of insulation are not available, apply mitered sections of phenolic-foam insulation. Secure insulation materials with wire, tape, or bands.
   3. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch (25 mm) at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

D. Apply insulation to valves and specialties as follows:
   1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
   2. When premolded sections of insulation are not available, apply mitered sections of phenolic-foam insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without distributing insulation.
   3. Apply insulation to flanges as specified for flange insulation application.
   4. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
   5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.8 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:
   1. Follow manufacturer's written instructions for applying insulation.
   2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

B. Apply insulation to flanges as follows:
   1. Apply pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of the same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

C. Apply insulation to fittings and elbows as follows:
1. Apply mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

D. Apply insulation to valves and specialties as follows:
1. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
2. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to stainer basket.
3. Apply insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

3.9 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.
1. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of jacket manufacturer's recommended adhesive.
3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

B. Foil and Paper Jackets: Apply foil and paper jackets where indicated.
1. Draw jacket material smooth and tight.
2. Apply lap or joint strips with the same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Apply jackets with 1-1/2-inch (40-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.

C. Apply metal jacket where indicated, with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.10 PIPING SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
1. Flexible connectors.
2. Fire-suppression piping.
3. Drainage piping located in crawl spaces, unless otherwise indicated.
4. Below-grade piping, unless otherwise indicated.
5. Chrome-plated pipes and fittings, unless potential for personnel injury.

6. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.11 INTERIOR INSULATION APPLICATION SCHEDULE

A. Service: Domestic water piping.
   1. Operating Temperature: 60 to 80 deg F
   2. Insulation Material: Mineral Fiber
   3. Insulation Thickness: 1" thick.
   4. Field-Applied Jacket: Foil and Paper(ASJ)
   5. Vapor Retarder Required: Yes.
   6. Finish: None.

B. Service: Domestic hot and recirculated hot water.
   1. Operating Temperature: 60 to 140 deg F (15 to 60 deg C).
   2. Insulation Material: Mineral fiber
   3. Insulation Thickness: 1" thick
   4. Field-Applied Jacket: Foil and Paper(ASJ)
   5. Vapor Retarder Required: No
   6. Finish: None.

C. Service: Condensate and equipment drain piping.
   1. Operating Temperature: 40 to 60 deg F
   2. Insulation Material: Flexible elastomeric, only on first ten feet of pipe from trap.
   3. Insulation Thickness: 3/4"
   4. Field-Applied Jacket: None.
   5. Vapor Retarder Required: No.
   6. Finish: Two coats of the insulation manufacturer's recommended protective coating.

D. Service: Refrigerant suction and hot-gas piping.
   1. Operating Temperature: 35 to 50 deg F
   2. Insulation Material: Flexible elastomeric.
   3. Insulation Thickness: 1" thick.
   4. Field-Applied Jacket: Aluminum Jacket on building exterior application only.
   5. Vapor Retarder Required: Yes.
   6. Finish: None.

E. Service: For obtaining fire/smoke rating in return air plenum (calbes, PE, PB, PP, ABS, PVC, CPVC, etc).
   1. Operating Temperature: 35 to 90 deg F
   2. Insulation Material: 3M Fire Barrier Plenum Wrap 5 A or equal.
   3. Insulation Thickness: larger of 1" or mfr's recommendations.
   4. Field-Applied Jacket: scrim reinforced foil
   5. Vapor Retarder Required: None.
   6. Finish: None.

3.12 EXTERIOR INSULATION APPLICATION SCHEDULE

A. Service: Domestic water.
   1. Operating Temperature: 60 to 140 deg F (15 to 60 deg C).
   2. Insulation Material: Mineral fiber.

3. Insulation Thickness: Apply the following insulation thicknesses: 1”
4. Field-Applied Jacket: Aluminum.
5. Vapor Retarder Required: Yes.
6. Finish: None.

B. Service: Refrigerant suction.
1. Operating Temperature: 35 to 50 deg F (2 to 10 deg C).
2. Insulation Material: Flexible elastomeric.
3. Insulation Thickness: Apply the following insulation thicknesses: ½”
4. Field-Applied Jacket: Aluminum
5. Vapor Retarder Required: Yes.
6. Finish: None.

END OF SECTION

SECTION 22 11 16

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Perform excavating and backfilling required by work of this Section.
   2. Furnish and install potable water piping complete with necessary valves, connections, and accessories inside building and connect with outside utility lines 5 feet from building perimeter as described in Contract Documents.

1.2 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
   1. Domestic Water Distribution Piping: 125 psig..

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data: For pipe, tube, fittings, and couplings.
   2. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

B. Informational Submittals:
   1. Test And Evaluation Reports:
      b. Written report of sterilization test.

C. Shop Drawings:
      b. Piping Layout:
         1) Provide as-built drawings at end of project.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Meet NSF International Standards for materials or products that come into contact with drinking water, drinking water treatment chemicals, or both for chemical contaminants and impurities that are indirectly imparted to drinking water from products, components, and materials used in drinking water systems.
   2. California only: California Assembly Bill 1953 (AB1953) Compliant for Lead Free.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic, potable domestic water piping and components.

D. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Manufacturers:
1. Manufacturer Contact List:
b. Aquatherm, Inc.,
c. Cash Acme,
d. Cla-Val Company,
e. Conbraco Industries Inc,
f. Hammond Valve,
g. Handy & Harmon Products Div,
h. Honeywell Inc,
i. Leonard Valve Co,
j. Milwaukee Valve Co,
k. Nibco Inc,
l. Rehau,
m. Sloan Valve Co,
n. Spence Engineering Co,
o. Symmons Industries, Braintree,
p. Uponor Inc,
q. Viega ProPress, Wic
r. Watts Regulator Co,
s. Wilkins (Zurn Wilkins),
t. Zurn PEX, Inc.

B. Materials:
1. Design Criteria:
b. All drinking water products, components, and materials above and below grade used in drinking water systems must meet NSF International Standards for Lead Free.
c. No CPVC allowed.
2. Pipe:
b. Copper:
3) Above-Grade:
a) Meet requirements of ASTM B88, Type K & L.
b) Hard Copper Tube: ASTM B 88, Types K and L, water tube, drawn tempered.

c) Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

d) Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

e) Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

f) Copper, Grooved-End Fittings: ASTM B 75 (ASTM B 75M) copper tube or ASTM B 584 bronze castings.

g) Copper-Tubing, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

4) Below-Grade:

a) Meet requirements of ASTM B88, Type K. 3/4 inch minimum under slabs.

b) 2 inches And Smaller: Annealed soft drawn.

c) 2-1/2 inches And Larger: Hard Drawn.

5) Fittings:

a) For Copper Pipe: Wrought copper.

3. Connections For Copper Pipe:

b. Above-Grade:

3) Sweat copper type with 95/5 or 96/4 Tin-Antimony solder, Bridgit solder, or Silvabrite 100 solder. Use only lead-free solder.

4) Viega ProPress System

c. Below Grade:

3) Brazed using following type rods:

a) Copper to Copper Connections:

2) AWS Classification BCuP-4 Copper Phosphorus (6 percent silver).

3) AWS Classification BCuP-5 Copper Phosphorus (15 percent silver).

4) Copper to Brass or Copper to Steel Connections: AWS Classification BAg-5 Silver (45 percent silver).

5) Do not use rods containing Cadmium.

6) Brazing Flux:

a) Approved Products:

1) Stay-Silv white brazing flux by Harris Product Group.

2) High quality silver solder flux by Handy & Harmon.

7) Joints under slabs acceptable only if allowed by local codes.

4. Ball Valves:

b. Use ball valves exclusively unless otherwise specified. Ball valves shall be by single manufacturer from approved list below.

c. Valves shall be two-piece, full port for 150 psi SWP.

3) Operate with flow in either direction, suitable for throttling and tight shut-off.

4) Body: Bronze, 150 psig wsp at 350 deg F and 400 psig wog.

5) Seat: Bubble tight at 100 psig under water.

d. Class One Quality Standard: Nibco T585 or S585.

3) Equal by Conbraco 'Apollo,' Hammond, Milwaukee, or Watts.

5. Combination Pressure Reducing Valve / Strainer:

b. Integral stainless steel strainer, or separate 'Y' strainer installed upstream of pressure reducing valve.

c. Built-in thermal expansion bypass check valve.

d. Class One Quality Standard: Watts LFU5B:

3) Equal by Cash Acme, Cla-Val Hi Capacity, Conbraco 36C, Honeywell-Braukmann, Spence Hi Capacity, Watts, or Wilkins. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Below Grade:

1. Install piping under slabs without joints where possible.
2. Insulate water piping buried within building perimeter.
3. Bury water piping 6 inches minimum below bottom of slab and encase in 2 inches minimum of sand.

B. Locate cold water lines a minimum of 6 inches from hot water line.

3.2 FIELD QUALITY CONTROL

A. Field Tests:

1. Before pipes are covered, test systems in presence of Architect/Engineer at 125 psig hydrostatic pressure for four (4) hours and show no leaks.
2. Disconnect equipment not suitable for 125 psig pressure from piping system during test period.

3.3 ADJUSTING

A. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

1. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
2. Adjust calibrated balancing valves to flows indicated.

3.4 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:

b. Flush piping system with clean, potable water until dirty water does not appear at outlets.

c. Fill and isolate system according to either of the following:
   3) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
   4) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.

d. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

e. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

D. Water system will not be accepted until negative bacteriological test is made on water taken from system. Repeat dosing as necessary until such negative test is accomplished.

END OF SECTION

SECTION 22 11 19

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Balancing valves.
   2. Washer-supply outlets.
   3. Key-operation hydrants.
   4. Trap seal primer valves.
   5. Drain valves.
   6. Miscellaneous piping specialties.
   7. Sleeve penetration systems.
   8. Flashing materials.

1.2 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Meet NSF International Standards for materials or products that come into contact with drinking water, drinking water treatment chemicals, or both for chemical contaminants and impurities that are indirectly imparted to drinking water from products, components, and materials used in drinking water systems.

PART 2 - PRODUCTS

2.1 BALANCING VALVES

A. Calibrated Balancing Valves: Adjustable, with two readout ports and memory setting indicator. Include manufacturer's standard hoses, fittings, valves, differential pressure meter, and carrying case.

B. Manufacturers:
   1. Armstrong Pumps, Inc.
   2. Flow Design, Inc.
   3. ITT Industries; Bell & Gossett Div.
   4. Taco, Inc.
   5. Watts Industries, Inc.; Water Products Div.
   6. 2” and Smaller: Bronze body with brass ball, adjustment knob, calibrated nameplate, and threaded or solder-joint ends.
   7. 2” and Smaller: Bronze, Y-pattern body with adjustment knob and threaded ends.
   8. 2.5” and Larger: Cast-iron, Y-pattern body with bronze disc and flanged or grooved ends.

C. B. Memory-Stop Balancing Valves, NPS 2 (DN 50) and smaller: MSS SP-110, ball valve, rated for 400-psig (2760-kPa) mininmum CWP. Include two-piece, copper-alloy body with full-port, chrome-plated brass ball, replaceable seats and seals, threaded or solder-joint ends, and vinyl-covered steel handle with memory-stop device.

D. Manufacturers:
   1. Conbraco Industries, Inc.
   2. Crane Co., Crane Valve Group; Crane Valves.
   3. Grinnell Corporation.
   4. NIBCO INC.
   5. Red-White Valve Corp.

2.2 STRAINERS

A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch (1.2-mm) round perforations, unless otherwise indicated.
   1. Pressure Rating: 125-psig (860-kPa) minimum steam working pressure, unless otherwise indicated.
   2. NPS 2 (DN 50) and Smaller: Bronze body, with female threaded ends.
   3. NPS 2-1/2 (DN 65) and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved, epoxy coating and flanged ends.

2.3 OUTLET BOXES

A. Manufacturers:
   1. Acorn Engineering Company.
   2. Gray, Guy Manufacturing Co., Inc.
   3. Symmons Industries, Inc.

B. General: Recessed-mounting outlet boxes with supply fittings complying with ASME A112.18.1M. Include box with faceplate, services indicated for equipment connections, and wood-blocking reinforcement.

C. Clothes Washer Outlet Boxes: With hot- and cold-water hose connections, drain, and the following:
   1. Box and Faceplate: [Stainless steel] [Enameled or epoxy-painted steel].
   2. Shutoff Fitting: Two hose bibbs.
   3. Supply Fittings: Two NPS 1/2 (DN 15) gate, globe, or ball valves and NPS 1/2 (DN 15) copper, water tubing.
   4. Drain: NPS 2 (DN 50) standpipe, P-trap, and direct waste connection to drainage piping.
   5. Inlet Hoses: Two ASTM D 3571, 60-inch- (1500-mm-) long, rubber household clothes washer inlet hoses with female hose-thread couplings.
   6. Drain Hose: One 48-inch- (1200-mm-) long, rubber household clothes washer drain hose with hooked end.

D. Icemaker Outlet Boxes: With hose connection and the following:
   1. Box and Faceplate: Stainless steel.
   2. Shutoff Fitting: Hose bibb.
   3. Supply Fitting: NPS 1/2 (DN 15) gate, globe, or ball valve and NPS 1/2 (DN 15) copper, water tubing.

2.4 KEY-OPERATION HYDRANTS

A. Manufacturers:
   1. Josam Co.
   2. Smith, Jay R. Mfg. Co.
   3. Woodford Manufacturing Co.

B. General: ASME A112.21.3M, key-operation hydrant with pressure rating of 125 psig.
   1. Inlet: 3/4 “ or NPS 1” threaded or solder joint.

2. Outlet: ASME B1.20.7, garden-hose threads.
3. Operating Keys: One with each key-operation hydrant.

C. Moderate-Climate, Concealed-Outlet Wall Hydrants: ASSE 1019, self-drainable with flush-mounting box with cover, integral nonremovable hose-connection vacuum breaker, and concealed outlet.
1. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.

D. Hot and Cold, Nonfreeze Concealed-Outlet Wall Hydrants: With deep flush-mounting box with cover; hot- and cold-water casings and operating rods to match wall thickness; concealed outlet; wall clamps; and factory- or field-installed, nonremovable and manual drain-type, hose-connection vacuum breaker complying with ASSE 1011.

2.5 ROOF HYDRANTS

A. Design Criteria:
1. Provide dual check backflow preventer.
2. Non-freeze.
3. Drain port - connect to drain

2.6 TRAP SEAL PRIMER VALVES

A. Supply-Type Trap Seal Primer Valves: ASSE 1018, water-supply-fed type, with the following characteristics:

B. Manufacturers:

1. Josam Co.
2. MIFAB Manufacturing, Inc.
3. Precision Plumbing Products, Inc.
4. Smith, Jay R. Mfg. Co.
5. 125-psig (860-kPa) minimum working pressure.
6. Bronze body with atmospheric-vented drain chamber.
7. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
8. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
9. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.7 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, metal-bellows type with pressurized metal cushioning chamber. Sizes indicated are based on ASSE 1010 or PDI-WH 201, Sizes A through F.

B. Manufacturers:
1. Josam Co.
2. Smith, Jay R. Mfg. Co.
3. Tyler Pipe; Wade Div.
4. Zurn Industries, Inc.; Specification Drainage Operation.

C. Hose Bibbs: Bronze body with replaceable seat disc complying with ASME A112.18.1M for compression-type faucets. Include NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet, of design suitable for pressure of at least 125 psig (860 kPa); integral [or field-installed,] nonremovable, drainable hose-connection vacuum breaker; and garden-hose threads complying with ASME B1.20.7 on outlet.

D. Roof Flashing Assemblies: Manufactured assembly made of [4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch- (1.6-mm-)] [6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch- (2.4-mm-)] thick, lead flashing collar and skirt extending at

least [6 inches (150 mm)] [8 inches (200 mm)] [10 inches (250 mm)] from pipe with galvanized steel boot reinforcement, and counterflashing fitting.

E. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.

F. Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semiopen top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.

G. Stack Flashing Fittings: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

H. Vent Caps: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and set-screws to secure to vent pipe.

I. Vent Terminals: Commercially manufactured, shop- or field-fabricated, frost-proof assembly constructed of galvanized steel, copper, or lead-coated copper. Size to provide 1-inch (25-mm) enclosed air space between outside of pipe and inside of flashing collar extension, with counterflashing.

J. Expansion Joints: ASME A112.21.2M, assembly with cast-iron body with bronze sleeve, packing gland, and packing; of size and end types corresponding to connected piping.

2.8 SLEEVE PENETRATION SYSTEMS

A. Manufacturers:
   1. ProSet Systems, Inc.

B. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.
   1. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
   2. Stack Fitting: ASTM A 48 (ASTM A 48M), gray-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and gray-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.
   3. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

2.9 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
   1. General Use: 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
   2. Vent Pipe Flashing: 3-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
   3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

B. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.

C. Fasteners: Metal compatible with material and substrate being fastened.

D. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

E. Solder: ASTM B 32, lead-free alloy.

F. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.
   1. Not required to meet NSF International Standards for Lead Free.

2. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
    1) Jay R. Smith: 5907.
    2) Prier: P-RH2.
    3) Woodford: RHY2-MS.
3. Water Hammer Arrestors:
    1. Design Criteria:
        1) Meet NSF International Standards for Lead Free.
        2) Nesting type, air pre-charged bellows with casing.
        3) Bellows constructed of stabilized 18-8 stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.
B. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve.
C. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
D. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
E. Install expansion joints on vertical risers, stacks, and conductors if indicated.

3.2 CONNECTIONS

A. Install piping adjacent to equipment to allow service and maintenance.
B. Ground equipment.
C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
D. Connect plumbing specialties and devices that require power.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
    1. Lead Sheets: Burn joints of lead sheets 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.
B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
    1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
    2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
    3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
C. Set flashing on floors and roofs in solid coating of bituminous cement.
D. Secure flashing into sleeve and specialty clamping ring or device.
E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled trap seal primer systems and their installation, including piping and electrical connections. Report results in writing.
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION

SECTION 22 13 13

FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:

1. Furnish and install soil, waste, and vent piping systems within building and connect with outside utility lines 5 feet out from building where applicable.
2. Perform excavation and backfill required by work of this Section.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Pre-Cover Observation.

1. Contact Architect/Engineer prior to covering any section of pipe.
2. All piping all be under pressure during observation

1.3 REFERENCES

A. Reference Standards:

1. International Code Council:
   a. ICC IPC-2012, 'International Plumbing Code'.

1.4 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings: For solvent drainage system, include plans, elevations, sections, and details.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PVC PIPING

A. PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.

1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

B. PVC Special Fittings: ASTM F 409, drainage-pattern tube and tubular fittings with ends as required for application.

C. Plenum Vent Lines: In areas of building with a return air plenum.

1. Approved Types:
   a. Service weight, single-hub or no-hub type cast iron soil pipe meeting requirements of ASTM A74.
   b. Vent lines 2-1/2 inches or smaller may be Schedule 40 galvanized steel.

c. Joint Material:
   1) Single-Hub: Rubber gaskets meeting requirements of ASTM C564.
   2) No-Hub Pipe: Neoprene gaskets with stainless steel cinch bands.
d. Fittings:
e. Cast Iron Pipe: Hub and spigot, except fittings for no-hub pipe shall be no-hub, and meet requirements of ASTM A74.
   1) Joint Material: Rubber gaskets meeting requirements of ASTM C564.
   2) Galvanized Pipe: Screwed Durham tarred drainage type.

2.2 EXECUTION

2.3 PIPING INSTALLATION

A. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

B. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight.

C. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep ¼ bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8- bend fittings if 2 fixture are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

D. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

E. Re-verify building drainage piping slope before covering pipe in trench if left uncovered over a 24 hour period of subjected to exterior water. If slope of piping has changed, provide new shoring material to maintain original slope after trench has been covered.

F. Install soil and waste drainage and vent piping at the code required minimum slopes, unless otherwise indicated:

G. Install engineered soil and waste drainage and vent piping systems in locations indicated and as follows:
   1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
   2. Cast-Iron, Sovent, Single Stack: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
   3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

H. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

I. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

J. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

K. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

2.4 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Section "Plumbing Fixtures."
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger

2.5 FIELD QUALITY CONTROL

A. Field Tests:

1. Conduct tests for leaks and defective work. Notify Architect before testing.
2. Thermoplastic Pipe System:
   a. Before backfilling and compacting of trenches, Fill waste and vent system with water to roof level or 10 feet minimum, and show no leaks for two hours. Correct leaks and defective work.
   b. After backfilling and compacting of trenches is complete but before placing floor slab, re-test as specified above. Uncover pipe and correct leaks and defective work. Re-backfill and compact and re-test.

B. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

C. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

D. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

E. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

2.6 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.
B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION

SECTION 22 13 19

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under this Section as described in Contract Documents.
   1. Cleanouts.
   2. Floor drains.

1.2 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
   1. Sanitary Waste and Vent Piping: 10-foot head of water.
   2. Storm Drainage Piping: 10-foot head of water.

1.3 SUBMITTALS

A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:
   1. Cleanouts, floor drains, and roof drains.
   2. Roof flashing assemblies.
   3. Grease interceptors(if applicable)
   4. Sleeve penetration systems.

PART 2 - PRODUCTS

2.1 SLEEVE PENETRATION SYSTEMS

A. Manufacturers:
   1. ProSet Systems, Inc.

B. Description: UL 1479, through-penetration firestop assembly consisting of sleeve and stack fitting with firestopping plug.
   1. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
   2. Stack Fitting: ASTM A 48 (ASTM A 48M), gray-iron, hubless-pattern, wye-branch stack fitting with neoprene O-ring at base and gray-iron plug in thermal-release harness in branch. Include PVC protective cap for plug.
      a. Special Coating: Include corrosion-resistant interior coating on fittings for plastic chemical waste and vent stacks.

2.2 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
   1. General Use: 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
   2. Vent Pipe Flashing: 3-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.

3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

B. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.

C. Fasteners: Metal compatible with material and substrate being fastened.

D. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

E. Solder: ASTM B 32, lead-free alloy.

F. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.3 CLEANOUTS

A. Cleanouts: Comply with [ASME A112.36.2M] [ASME A112.3.1] <Insert other>.

1. Application: [Floor cleanout] [Wall cleanout] [For installation in exposed piping].
2. Products:
   a. Josam Co.
   b. Mifab
   c. Smith, Jay R. Mfg. Co.
   d. Tyler Pipe, Wade Div.
   e. Zurn Industries, Inc., Specification Drainage Operation.

2.4 FLOOR DRAINS

A. Floor Drains.

1. Products:
   a. Josam Co.
   b. Mifab
   c. Smith, Jay R. Mfg. Co.
   d. Tyler Pipe, Wade Div.
   e. Zurn Industries, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

C. Install expansion joints on vertical risers, stacks, and conductors if indicated.

D. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
4. Locate at base of each vertical soil and waste stack.

E. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.

F. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.
G. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.
H. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.
I. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch (25-mm) clearance between vent pipe and roof substrate.
J. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
    1. Position floor drains for easy access and maintenance.
    2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
        a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
        b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
        c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.
    3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
    4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
K. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
    1. Install roof-drain flashing collar or flange so no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
    2. Position roof drains for easy access and maintenance.
L. Install interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

    1. Flush with In-Ground Installation: Set unit and extension, if required, with cover flush with finished grade.
    2. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.
M. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.
N. Fasten recessed-type plumbing specialties to reinforcement built into walls.
O. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.
P. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Install piping adjacent to equipment to allow service and maintenance.
B. Ground equipment.

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
D. Connect plumbing specialties and devices that require power according to Division Sections.
E. Interceptor Connections: Connect piping, flow-control fittings, and accessories.
   1. Grease Interceptors: Connect inlet and outlet to unit, and flow-control fitting and vent to unit inlet piping.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
   1. Lead Sheets: Burn joints of lead sheets 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.
B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
   1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
   2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
   3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
C. Set flashing on floors and roofs in solid coating of bituminous cement.
D. Secure flashing into sleeve and specialty clamping ring or device.
E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings.
F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled trap seal primer systems and their installation, including piping and electrical connections. Report results in writing.
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 33 00

ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:

1. Furnish and install electric water heater as specified in Contract Documents.

B. Related Requirements:

1. Section 22 0501: 'Common Plumbing Requirements'.
2. Section 22 1116: 'Domestic Water Piping'.

1.2 REFERENCES

A. Reference Standard:

1. NSF International Standard / American National Standards Institute:
   a. NSF/ANSI 61-2012, 'Drinking Water System Components - Health Effects'.
   b. NSF/ANSI 372-2011, 'Drinking Water System Components - Lead Content'.

B. SUBMITTALS

C. Closeout Submittals:

1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
   a. Operations and Maintenance Data:
      1) Maintenance and operational instructions.
   b. Warranty Documentation:
      1) Final, executed copy of Warranty.
   c. Record Documentation:
      1) Manufacturers documentation:
         a) Manufacturer's literature or cut sheet.

1.3 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:

1. Meet NSF International Standards for materials or products that come into contact with drinking water, drinking water treatment chemicals, or both for chemical contaminants and impurities that are indirectly imparted to drinking water from products, components, and materials used in drinking water systems.
2. California only: California Assembly Bill 1953 (AB1953) Compliant for Lead Free.

1.4 WARRANTY

A. Special Warranty:

1. Three-year non-prorated warranty on water heaters of 20 gallon capacity and larger.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:

1. Manufacturer Contact List:
   a. A O Smith Water Products Co,
   b. Bradford-White Corp, Ambler,.
   c. Rheem / Ruud Water Heater Div
   d. Ruud Manufacturing Co.,

e. State Industries Inc,

B. Materials:

1. Design Criteria:
   a. All (wetted) drinking water products, components, and materials used in drinking water systems must meet NSF International Standards for Lead Free.
   b. All water heaters require 'Tempered Water Temperature Control' (mixing valves) as specified in Section 22 1116.
2. 30 Gallon to 50 Gallon Regular Height:
   a. Glass lined storage tank pressure tested and rated for 125 psi (862 kPa) working pressure.
   b. Water heaters shall each have ASME rated temperature-pressure relief valve rated at MBH input of heater minimum set to relieve at 120 psi (827 kPa).
   c. 9 Kw.
   d. 3 inches (75 mm) minimum glass fiber or polyurethane foam insulation.
   e. Complete with two stage thermostat, magnesium anode, electric sheath rod type heating element, and high limit control.
   f. Heater shall be pre-wired and entire unit bear UL label.
   g. Manufactures
      1) American:
      2) A O Smith:
      3) Bradford White:
      4) Rheem
      5) State Industries: SB6-40.

2.2 ACCESSORIES

A. Anchoring Components:
   1. One inch (25 mm) by 18 ga (1.2 mm) galvanized steel straps.
   2. No. 10 by 2-1/2 inch (64 mm) screws.

B. Thermal Expansion Absorbers:
   1. Bladder type for use with potable water systems.

C. Type One Acceptable Products.
   a. Therm-X-Trol ST-12-C by Amtrol Inc, West Warwick, RI www.amtrol.com.
   b. Equal as approved by Architect before bidding.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install temperature-pressure relief valve on hot water heater and pipe discharge to directly above funnel of floor drain.

3.2 ADJUSTING

A. Set discharge water temperature at 140 deg F (60 deg C). Final hot water temperature shall be 110 deg F (43 deg C) after missing valve. If no mixing valve set discharge temperature at 110 deg F (43 deg C).

END OF SECTION

SECTION 22 42 00

COMMERCIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes plumbing fixtures and related components.

1.3 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

1.4 SUBMITTALS

A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.

C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

E. TAS: Texas Accessibility Standards.

1.6 COORDINATION

A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. For fixture descriptions in other Part 2 articles where the subparagraph titles "Products," and "Manufacturers" introduce a list of manufacturers and their products or manufacturers only, the following requirements apply for product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified in other Part 2 articles.

2.2 LAVATORY FAUCETS

A. Lavatory Faucet: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.

1. Products:
   a. American Standard.
   b. Eljer.
   c. Kohler.

2.3 SINK FAUCETS

A. Sink Faucet: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.

1. Manufacturers:
   a. American Standard.
   b. Eljer
   c. Kohler

2.4 TOILET SEATS

A. Toilet Seat: Solid plastic.

1. Manufacturers:
   a. Bemis.
   b. Beneke.
   c. Centoco.
   d. Church.

2.5 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Guard, Manufactured, plastic enclosure for covering for hot- and cold-water supplies and trap and drain piping and complying with ADA requirements.

1. Manufacturers:
   a. Engineered Brass Co.
   b. Plumerex
   c. Truebro.

2.6 FIXTURE SUPPORTS

A. Water-Closet Support: Water-closet combination carrier designed for accessible and standard mounting heights. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

1. Manufacturers:
   a. Mifab
   b. Josam.
   c. Wade.
   d. Zurn

B. Urinal Support: Not required

C. Lavatory Support: Not required

D. Sink Support: Type II, sink carrier with hanger plate, bearing studs, and tie rod. Include steel uprights with feet.
   1. Manufacturers:
      a. Josam.
      b. J.R. Smith
      c. Zurn.

2.7 WATER CLOSETS

A. Water Closets: Accessible, wall-hanging, back-outlet, vitreous-china fixture designed for flushometer valve operation.
   1. Products:
   2. American Standard, Inc.
   3. Kohler Co.
   4. TOTO USA, Inc.

B. Water Closets: Ligature Resistant Institutional Combination Lavatory/Toilet
   1. Products:
      a. ACORN
      b. All others shall be submitted for pre-approval prior to bid date.

2.8 LAVATORIES, SINKS

A. Lavatories,: Accessible, counter top, vitreous-china fixture.
   1. Products:
      a. American Standard, Inc.
      b. Kohler Co.
      c. Toto
      d. CRANE

2.9 SINKS

A. Sinks: Commercial, counter-mounting, stainless-steel fixture.
   1. Products:
      a. Elkay Manufacturing Co.
      b. Just Manufacturing Co.

2.10 SERVICE SINKS

A. Service/Mop Sinks: Floor-mounting, enameled, sink with front apron, raised back, and coated, wire rim guard.
   1. Products:
      a. Commercial Enameling Co.
      b. Kohler Co.
      c. Fiat

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.
B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FIXTURE INSTALLATION

A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.
   1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
   2. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-hanging fixtures with tubular waste piping attached to supports.

F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.

G. Install counter-mounting fixtures in and attached to casework.

H. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.

I. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
   1. Exception: Use ball, gate, or globe valve if stops are not specified with fixture. Refer to Division 15 Section "Valves" for general-duty valves.

J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

L. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

M. Install toilet seats on water closets.

N. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

O. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.

P. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

Q. Install traps on fixture outlets.

R. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for escutcheons.

S. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water supplies from water distribution piping to fixtures.

C. Connect drain piping from fixtures to drainage piping.

D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.

E. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.

F. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Verify that installed fixtures are categories and types specified for locations where installed.

B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets, shower valves, and flushometer valves to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 47 13

DRINKING FOUNTAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Drinking fountains.
   2. Self-contained water coolers.
   3. Fixture supports.

1.3 DEFINITIONS

A. Accessible Drinking Fountain and Water Cooler: Fixture that can be approached and used by people with disabilities.
B. Drinking Fountain: Fixture with nozzle for delivering stream of water for drinking.
C. Fitting: Device that controls flow of water into or out of fixture.
D. Fixture: Drinking fountain or water cooler, unless one is specifically indicated.
E. Water Cooler: Electrically powered fixture for generating and delivering cooled drinking water.

1.4 SUBMITTALS

A. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each type of fixture indicated.
B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
C. Maintenance Data: For fixtures to include in maintenance manuals specified in Division.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" about fixtures for people with disabilities.
C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
D. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
E. TAS: Texas Accessibility Standards.

1.6 COORDINATION

A. Coordinate roughing-in and final fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified below.
   1. Elkay.
   2. Halsey Taylor.
   3. Haws Corporation.

2.2 DRINKING FOUNTAINS

A. Drinking Fountains,: Accessible, Style W, wall-hanging fixture made of stainless steel.
   1. Receptor Shape: Rectangular.
   2. Back Panel: Stainless-steel wall plate behind drinking fountain.
   3. Bubblers: Two, with automatic stream regulator, located on deck.
   4. Control: Push button.
   5. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve.
   6. Drain: Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME Standards.
   7. Support: Type I, water-cooler carrier. Refer to "Fixture Supports" Article.

2.3 SELF-CONTAINED WATER COOLERS

A. Water Coolers: Accessible, ARI 1010, Type PB, pressure with bubbler, Style W, wall-hanging fixture.
   1. Cabinet: Bilevel with two attached cabinets, enameled steel with stainless-steel top.
   2. Bubbler: One, with automatic stream regulator, located on each cabinet deck.
   3. Control: Push button.
   4. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve and filter.
   5. Drain: Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME Standards.
   6. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
      a. Capacity: 8 gph (0.0084 L/s) of 50 deg F (10 deg C) cooled water from 80 deg F (27 deg C) inlet water and 90 deg F (32 deg C) ambient air temperature.
      b. Electrical Characteristics: 1/5 hp; 120-V ac; single phase; 60 Hz.
   7. Support: Type II, water-cooler carrier. Refer to "Fixture Supports" Article.

2.4 FIXTURE SUPPORTS

A. Off-Floor, Plumbing Fixture Supports: ASME A112.6.1M, water-cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.
   1. Available Manufacturers:
   2. Manufacturers:
      a. Josam Co.
      b. Smith, Jay R. Mfg. Co.
      c. Tyler Pipe; Wade Div.
      d. Zurn Specifications Drainage Operation.
   3. Type I: Hanger-type carrier with two vertical uprights.
   4. Type II: Bilevel, hanger-type carrier with three vertical uprights.
   5. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.

B. Examine walls and floors for suitable conditions where fixtures are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Use carrier off-floor supports for wall-hanging fixtures, unless otherwise indicated.

B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.

3.3 INSTALLATION

A. Install off-floor supports affixed to building substrate and attach wall-hanging fixtures, unless otherwise indicated.

B. Install mounting frames affixed to building construction and attach recessed water coolers to mounting frames, unless otherwise indicated.

C. Install fixtures level and plumb.

D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Refer to Division Section "Valves" for general-duty valves.

E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

F. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Refer to Division Section "Basic Mechanical Materials and Methods" for escutcheons.

G. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division for sealant and installation requirements.

3.4 CONNECTIONS

A. Piping installation requirements are specified in other Division Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water supplies from water distribution piping to fixtures.

C. Connect drain piping from fixtures to drainage piping.

D. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

END OF SECTION

SECTION 23 00 00

HEATING, VENTILATION AND AIR-CONDITIONING (HVAC)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, as is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.

B. Mechanical Contract Documents were prepared for the Project by:

Trinity MEP Engineering, LLC
3533 Moreland Dr. Ste. A
Weslaco, Texas 78596
Phone Number: (956) 973-0500
Contact Person: Leonardo Munoz, P.E.

C. General Scope of Work:

1. Install AC equipment and ductwork as shown on the contract documents. Refer to drawings for schedule of equipment that will be installed. After installing equipment, connect power to unit.
2. HVAC: Provide all materials and labor associated with a complete operational installation of new HVAC systems including, but not limited to:

- DX Split System A/C Units
- Exhaust fans
- Sheet metal, Ductwork
- Diffusers and Grilles
- Duct accessories, including grilles, and louvers
- Air Test and Balance

1.3 COORDINATION

A. All mechanical work shall be done under sub-contract to a General Contractor. Mechanical Contractor shall coordinate all work through General Contractor, even in areas where only mechanical work is to take place.

B. Coordination between all trades shall take place on a regular basis to avoid conflicts between disciplines and equipment clearances.

C. Work shall take place with minimal disruption to Owner's operations in areas surrounding the new building.

D. Cooperate fully with other contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

E. Fully coordinate with electrical contractor for providing power to mechanical equipment.

F. Mechanical Contractor is responsible for all control wiring including thermostat(s). This includes all conduit, wire, and accessories both low voltage and source voltage for the controls' system. Mechanical Contractor will provide all the necessary actuators, relays, software, hardware, and all necessary accessories required for a fully functional controls' system.

1.4 UTILITIES

1. Coordinate with power, water, telephone, cable and gas utilities to locate all utilities prior to digging in any area.
2. Obtain any approvals required from utilities to relocate utilities.
3. Cost of relocating or bypassing utilities indicated on drawings shall be included in Base Bid.

1.5 CONTRACTOR USE OF PREMISES

A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

1. Owner Occupancy: Allow for Owner occupancy and use by the public.
2. Driveways and Entrances: Keep driveways and entrances serving the premises, clear and available to the Owner, the Owner's employees, and emergency vehicles at all time. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:

1. Temporary fencing around construction areas.
2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be covered at night and warning lights provided on construction barricades.
3. Temporary fencing around equipment while site work is in progress.

1.6 SUBMITTALS

1. To extradite the submittal process more efficiently, DO NOT piece-meal the submittals. Submit entire mechanical or plumbing in a bound enclosure. This will eliminate delays in the submittal process.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Sections.

1. Piping materials and installation instructions common to most piping systems.
2. Concrete base construction requirements.
3. Escutcheons.
4. Dielectric fittings.
5. Flexible connectors.
6. Mechanical sleeve seals.
7. Equipment nameplate data requirements.
8. Nonshrink grout for equipment installations.
9. Field-fabricated metal and wood equipment supports.
10. Installation requirements common to equipment specification sections.
11. Cutting and patching.
12. Touchup painting and finishing.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

G. PVC: Polyvinyl chloride plastic.

H. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene propylene diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.

B. Coordination Drawings: Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work. Include the following:
   1. Planned piping layout, including valve and specialty locations and valve-stem movement.
   2. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
   3. Sizes and location of required concrete pads and bases.
   4. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
   5. Reflected ceiling plans to coordinate and integrate installation of air outlets and inlets, light fixtures, communication system components, sprinklers, and other ceiling-mounted items.

1.5 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes, ductwork, equipment, and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

F. Coordinate requirements for access panels and doors if mechanical items requiring access are concealed behind finished surfaces. Access panels and doors are specified in architectural section.

G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

1.8 OPERATION PRIOR TO ACCEPTANCE

A. When any equipment is operable, and it is to the advantage of the Contractor to operate the equipment, he may do so provided that he properly supervises the operation, and retains full responsibility for the equipment operated.

B. Regardless of whether or not the equipment has or has not been operated, the Contractor shall clean the equipment properly, make required adjustments, and complete punch list items before final acceptance by the Owner.

C. The date of acceptance by the Engineer, for beneficial use by the Owner, shall be the beginning date of the warranty period.

1.9 SPACE AND EQUIPMENT ARRANGEMENT

A. The size of each item of mechanical equipment shown on the Drawings is based on the dimensions of a particular manufacturer as indicated. While other manufacturers may be acceptable, it shall be the responsibility of the Contractor to determine whether or not the equipment he proposes to furnish will fit into the space. Shop drawings shall be prepared when required by the engineer to indicate a suitable arrangement.

B. Install equipment in a manner to permit access to all surfaces. Install valves, motors, drives, lubricating devices, filters, and other accessory items in a position to allow removal for service without requiring the disassembly of another part.

C. Provide access panels acceptable to the Engineer for equipment that is concealed above ceiling space.

D. Large equipment assemblies or components which will be installed in the building, and which are too large to permit access through doorways, stairways or shafts, shall be brought to the site and placed in the appropriate spaces before the enclosing structure is completed. Provisions shall be implemented by the Contractor to insure that the equipment will not be damaged in any way during the associated construction procedures.

1.10 START-UP OF EQUIPMENT AND SYSTEMS

A. Whenever the manufacturer of a particular item of equipment or a particular system makes available a start-up service after completion of the installation, such manufacturer's start-up service (rendered by the manufacturer or his authorized representative) shall be provided.

B. Witnessing and explanations of start-up services shall be included as part of the "Instruction of Owner's Personnel" as specified below.

1.11 INSTRUCTION OF OWNER'S PERSONNEL

A. Provide the services of competent engineers or technicians acceptable to the Engineer to instruct representatives of the Owner in complete and detailed operation and maintenance of each item of equipment, and each system. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results. Upon completion of these instructions, the Contractor shall obtain a letter of release, acknowledged by the Owner or his authorized representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.

B. The Contractor shall be fully responsible for proper maintenance of equipment and systems until the instructions have been given to the Owner's personnel and the letter of release acknowledged.

C. In providing the instructions to the Owner's personnel, the written operating and maintenance manuals shall be followed in all instances, and the Owner's personnel shall be familiarized with such manuals. Operating and maintenance manuals used for instructions shall include piping diagrams, valve identification charts, control and interlocking wiring diagrams, manufacturers' operation and maintenance manuals, parts lists (with sources identified), and other data as appropriate for each system, and as required elsewhere in the Specifications to be furnished to the Owner prior to final acceptance of the project.

D. Provide the Owner with three (3) complete sets of all maintenance manuals, pamphlets, brochures or instructions. This material shall be catalogued, indexed and bound into books.

1.12 ACCEPTABLE MANUFACTURERS

A. A. Provide equipment and materials from listed manufacturers listed within this specification. Deviations from this specification will not be acceptable. When one manufacturer is listed, alternate materials and equipment may be provided "equal to" the listed. When more than one manufacturer is listed, equipment and material must be provided by one of the listed manufacturers.

PART 2 - PRODUCTS

2.1 STANDARD PRODUCTS

A. Each item of equipment furnished under this Division of the Specifications shall be essentially the standard product of the manufacturer. Where two or more units of the same kind or class of equipment are required, these shall be the products of a single manufacturer; however, the component parts of the equipment need not be the products of one manufacturer.

B. Materials and equipment shall be of the base quality normally used in good commercial practice, and shall be the products of reputable domestic manufacturers unless otherwise specified. Each major component shall bear a nameplate giving the name and address of the manufacturer, and the catalog number or designation of the component.

2.2 QUALITY AND CLASSIFICATION OF MATERIALS

A. Materials and equipment shall be new and of the quality specified, and shall be free from defects at the time of installation. Materials or equipment damaged in shipment or otherwise damaged prior to installation shall not be repaired at the job site, but shall be replaced with new materials or equipment identical with those damaged.

B. Wherever a UL standard has been established for a particular type of material or equipment, each such material or equipment provided on this project shall meet the requirements of the UL standard in every way and shall be UL listed and labeled.

2.3 LOCAL PARTS AND SERVICE

A. Each item of equipment furnished on this project shall have local representation, factory-authorized service, and an adequate stock of repair parts. "Local" shall be defined, for this purpose, as "within 50 miles of the project site."

2.4 FLAME SPREAD PROPERTIES OF MATERIALS

A. Materials used for insulation, acoustical linings, adhesives, jackets and coatings, and combinations of these materials, shall each have a flame spread rating of 25 or less, and a smoke developed rating of 50 or less, as determined by an independent testing laboratory in accordance with NFPA-255.

2.5 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dielectric Unions:

a. Watts Industries, Inc.; Water Products Div.
b. Zurn Industries, Inc.; Wilkins Div.

2. Mechanical Sleeve Seals:
a. Calpico, Inc.
b. Metraflex Co.
c. Thunderline/Link-Seal.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

2.7 PIPING SPECIALTIES

A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
1. Steel Sheet Metal: 0.0239-inch minimum thickness, galvanized, round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
4. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
a. Underdeck Clamp: Clamping ring with set screws.

B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.
1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
2. OD: Completely cover opening.
3. Cast Brass: One piece, with set screw.
a. Finish: Rough brass.
b. Finish: Polished chrome-plate.

4. Cast-Iron Floor Plate: One-piece casting.

2.8 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psig, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
F. Install piping free of sags and bends.
G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
I. Install piping to allow application of insulation plus 1-inch clearance around insulation.
J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
K. Install fittings for changes in direction and branch connections.
L. Install couplings according to manufacturer's written instructions.
M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:
    1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish.
    2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
    3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
    4. Insulated Piping: Cast brass or stamped steel; with concealed hinge, spring clips, and chrome-plated finish.
    5. Piping in Utility Areas: Cast brass or stamped steel, with set-screw or spring clips.
N. Sleeves are not required for core drilled holes.
O. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.
P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
    1. Cut sleeves to length for mounting flush with both surfaces.
        a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
    2. Build sleeves into new walls and slabs as work progresses.
    3. Install sleeves large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:Steel Pipe Sleeves: For pipes smaller than 6-inch NPS.
        b. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS and larger, penetrating gypsum-board partitions.
    4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants.
    5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.
Q. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe or pipe insulation and sleeve for installing mechanical sleeve seals.
    1. Install steel pipe for sleeves smaller than 6 inches in diameter.
    2. Install cast-iron "wall pipes" for sleeves 6 inches in diameter and larger.
    3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.
R. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

V. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
4. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
   c. Align threads at point of assembly.
   d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
   e. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
6. Welded Joints: Construct joints according to AWS D10.12, "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe," using qualified processes and welding operators according to "Quality Assurance" Article.
7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
8. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following:
   a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   b. PVC Nonpressure Piping: ASTM D 2855.
   c. PVC to ABS Nonpressure Transition Fittings: Procedure and solvent cement according to ASTM D 3138.
9. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657 procedures and manufacturer's written instructions.
   a. Plain-End Pipe and Fittings: Use butt fusion.
   b. Plain-End Pipe and Socket Fittings: Use socket fusion.

W. Piping Connections: Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2-inch NPS and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2-inch NPS and larger, adjacent to flanged valves and at final connection to each piece of equipment with flanged pipe connection.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.2 EQUIPMENT AND MATERIAL INSTALLATION - COMMON REQUIREMENTS

A. Install equipment and material to provide maximum possible headroom, if mounting heights are not indicated.
B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Architect.
C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
E. Install equipment and ductwork giving right of way to piping installed at required slope.
F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.3 PAINTING AND FINISHING

A. Refer to paint materials, surface preparation, and application of paint.
B. Do not paint piping specialties with factory-applied finish.
C. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psig, 28-day compressive-strength concrete and reinforcement or as specified.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.6 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.
B. Repair cut surfaces to match adjacent surfaces.

3.7 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.
B. Clean surfaces that will come into contact with grout.
C. Provide forms as required for placement of grout.
D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.
F. Place grout on concrete bases to provide smooth bearing surface for equipment.
G. Place grout around anchors.
H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION

SECTION 23 05 29

HANGER & SUPPORTS FOR HVAC PIPING & EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

.1 Section includes:

.1 Concrete housekeeping pads, hangers and supports for mechanical piping, ducting and equipment.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.
.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal
.3 Section 03 30 00 - Cast-in-Place Concrete.
.4 Section 05 12 23 - Structural Steel for Buildings.
.5 Section 05 50 00 - Metal Fabrications.

1.3 REFERENCES

.1 American National Standards Institute/ American Society of Mechanical Engineers (ANSI/ASME)

.1 ANSI/ASME B31.1, Power Piping, (SI Edition).

.2 American Society for Testing and Materials (ASTM)

.1 ASTM A125, Specification for Steel Springs, Helical, Heat-Treated.
.2 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
.3 ASTM A563, Specification for Carbon and Alloy Steel Nuts.

.3 Factory Mutual (FM)

.4 Health Canada / Workplace Hazardous Materials Information System (WHMIS).

.1 Materials Safety Data Sheets (MSDS).

.5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture.
.2 ANSI/MSS SP-69, Pipe Hangers and Supports - Selection and Application.
.3 MSS SP-89, Pipe Hangers and Supports - Fabrication and Installation Practices.

.6 Underwriter's Laboratories of Canada (ULC)

1.4 SYSTEM DESCRIPTION

.1 Design Requirements

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
.2 Base maximum load ratings on allowable stresses prescribed by MSS SP58 or ASME B31.1.
.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
.4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP58.

.2 Performance Requirements

.1 Design supports, platforms, catwalks, hangers, to withstand seismic events for location as per the National Building Code

1.5 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Shop drawings: submit drawings stamped and signed for approval by Owner's Representative.

.3 Submit shop drawings and product data for following items:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

.4 Quality assurance submittals: submit following in accordance with Section 01 33 00 - Submittal Procedures.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.1 Owner's Representative will make available 1 copy of systems supplier's installation instructions.

.5 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals

1.6 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

PART 2 - PRODUCTS

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP-58 and SP-89.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: galvanized painted with zinc-rich paint after manufacture.

.2 Use electro-plating galvanizing process or hot dipped galvanizing process.

.3 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.

.2 Upper attachment structural: Suspension from lower flange of I-Beam.

.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
.1 Rod: 9 mm UL listed, 13 mm FM approved.
.2 Cold piping NPS 2 1/2 or greater, hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed, FM approved where required to MSS-SP58 and MSS-SP69.

.3 Upper attachment structural: Suspension from upper flange of I-Beam.

.1 Cold piping NPS 2 maximum: Ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed FM approved where required to MSS SP69.
.2 Cold piping NPS 2 1/2 or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed, FM approved where required.

.4 Upper attachment to concrete.

.1 Ceiling: Carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.
.2 Concrete inserts: wedge shaped body with knockout protector plate UL listed FM approved where required to MSS SP-69.

.5 Shop and field-fabricated assemblies.

.1 Trapeze hanger assemblies: MSS SP-89.
.2 Steel brackets: MSS SP-89.
.3 Sway braces for seismic restraint systems: to MSS SP-89.

.6 Hanger rods: threaded rod material to MSS SP-58.

.1 Ensure that hanger rods are subject to tensile loading only.
.2 Provide linkages where lateral or axial movement of pipework is anticipated.
.3 Do not use 22 mm or 28 mm rod.

.7 Pipe attachments: material to MSS SP-58.

.1 Attachments for steel piping: carbon steel galvanized.
.2 Attachments for copper piping: copper plated black steel.
.3 Use insulation saddles for hot pipework.
.4 Oversize pipe hangers and supports for insulated pipes.

.8 Adjustable clevis: material to MSS SP-69, UL listed FM approved, where required clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-69.

.10 U-bolts: carbon steel to MSS SP-69 with 2 nuts at each end to ASTM A563.

.1 Finishes for steel pipework: galvanized.
.2 Finishes for copper, glass, brass or aluminum pipework: black with formed portion plastic coated or epoxy coated.

.11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP-69.

2.3 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized black carbon steel to MSS SP-58, type 42, UL listed FM approved where required.
.2 Copper pipe: carbon steel copper plated to MSS SP-58, type 42.
.3 Bolts: to ASTM A307.
.4 Nuts: to ASTM A563.

2.4 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 64 kg/m^3 density insulation plus insulation protection shield to: MSS SP-69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP-69.

2.5 CONSTANT SUPPORT SPRING HANGERS

.1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with Certified Mill Test Report(CMTR).

.2 Load adjustability: 10 % minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.

.3 Provide upper and lower factory set travel stops.

.4 Provide load adjustment scale for field adjustments.

.5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.

.6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.6 VARIABLE SUPPORT SPRING HANGERS

.1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.

.2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.

.3 Variable spring hanger to be complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

.4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5 % spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

2.7 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings. Submit calculations with shop drawings.

2.8 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

.1 Provide templates to ensure accurate location of anchor bolts.

2.9 PLATFORMS AND CATWALKS

.1 To Section 05 50 00 - Metal Fabrication.

2.10 HOUSE-KEEPING PADS

.1 For base-mounted equipment: Concrete, at least 100 mm high, 50 mm larger all around than equipment, and with chamfered edges.

.2 Concrete: to Section 03 30 00 - Cast-in-place Concrete by Division 3.

2.11 OTHER EQUIPMENT SUPPORTS

.1 From structural grade steel meeting requirements of Section 05 12 23 - Structural Steel for Buildings.

.2 Submit structural calculations with shop drawings.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer's instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps, boilers, chillers, cooling towers, elsewhere as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
.2 Bolt-tightening torques to be to industry standards.
.3 Steel pipes: Install below coupling or shear lugs welded to pipe.
.4 Cast iron pipes: Install below joint.

.4 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use approved constant support type hangers where:

.1 vertical movement of pipework is 13 mm or more,
.2 transfer of load to adjacent hangers or connected equipment is not permitted.

.7 Use variable support spring hangers where:

.1 transfer of load to adjacent piping or to connected equipment is not critical.
.2 variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

.1 Plumbing piping: most stringent requirements of Canadian Plumbing Code

.2 Fire protection: to applicable fire code.

.3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.

.4 Copper piping: up to NPS 1/2: every 1.5 m.

.5 Hydronic, steam, condensate, rigid, and flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

Maximum Pipe Size: NPS	Maximum Spacing: Steel	Maximum Spacing: Copper
up to 1-1/4	2.1 m	1.8 m
1-1/2	2.7 m	2.4 m
2	3.0 m	2.7 m
2-1/2	3.6 m	3.0 m
3	3.6 m	3.0 m
3-1/2	3.9 m	3.3 m
4	4.2 m	3.6 m
5	4.8 m	
6	5.1 m	
8	5.7 m	

Maximum Pipe Size: NPS	Maximum Spacing: Steel	Maximum Spacing: Copper
10	6.6 m	
12	6.9 m	

.6 Within 300 mm of each elbow.

.7 Pipework greater than NPS 12: to MSS SP69.

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members, comprised of angel iron or c-channel.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

END OF SECTION

SECTION 23 05 63

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

1.2 SUMMARY

A. This Section includes the following mechanical identification materials and their installation:
   1. Equipment nameplates.
   2. Equipment markers.
   3. Access panel and door markers.
   4. Pipe markers.
   5. Duct markers.
   6. Valve tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
   1. Data:
      a. Manufacturer, product name, model number, and serial number.
      b. Capacity, operating and power characteristics, and essential data.
      c. Labels of tested compliances.
   2. Location: Accessible and visible.
   3. Fasteners: As required to mount on equipment.

B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
   1. Terminology: Match schedules as closely as possible.
   2. Data:
      a. Name and plan number.
      b. Equipment service.
      c. Design capacity.
      d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
   3. Size: 2-1/2 by 4 inches (64 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.
   4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
   1. Colors: Comply with ASME A13.1, unless otherwise indicated.
   2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
   3. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers extending 360 degrees around pipe at each location.
   4. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
   5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.

E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils (0.08 mm) thick with pressure-sensitive, permanent-type, self-adhesive back.
   1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): 3/4 inch (19 mm) minimum.
   2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches (150 mm) or Larger: 1-1/2 inches (38 mm) minimum.

2.3 DUCT IDENTIFICATION DEVICES

A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers, with numbering scheme [approved by Architect] <Insert other>. Provide 5/32-inch (4-mm) hole for fastener.
   1. Material: 3/32-inch- (2.4-mm-) thick laminated plastic with 2 black surfaces and white inner layer.
   2. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Divisions. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
   1. Pumps, compressors, chillers, condensers, and similar motor-driven units.
   2. Heat exchangers, coils, evaporators, and similar equipment.

3. Fans, blowers, primary balancing dampers, and mixing boxes.
4. Packaged HVAC central-station and zone-type units.

B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
   1. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
   3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
      a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
      b. Fire department hose valves and hose stations.
      c. Meters, gages, thermometers, and similar units.
      d. Pumps, compressors, chillers, condensers, and similar motor-driven units.
      e. Heat exchangers, coils, evaporators, and similar equipment.
      f. Fans, blowers, primary balancing dampers, and mixing boxes.
      g. Packaged HVAC central-station and zone-type units.
      h. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

C. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.
   1. Identify mechanical equipment with equipment markers in the following color codes:
      a. Green: For cooling equipment and components.
      b. Yellow: For heating equipment and components.
      c. Orange: For combination cooling and heating equipment and components.
   2. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
   4. Include signs for the following general categories of equipment:
      a. Main control and operating valves, including safety devices.
      b. Pumps, compressors, chillers, condensers, and similar motor-driven units.
      c. Heat exchangers, coils, evaporators, and similar equipment.
      d. Fans, blowers, primary balancing dampers, and mixing boxes.
      e. Packaged HVAC central-station and zone-type units.
      f. Tanks and pressure vessels.
      g. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

D. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
   1. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Pretensioned pipe markers. Use size to ensure a tight fit.
   2. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches (38 mm) wide, lapped at least 3 inches (75 mm) at both ends of pipe marker, and covering full circumference of pipe.

B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
   7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.4 DUCT IDENTIFICATION

A. Install duct markers with permanent adhesive on air ducts in the following color codes:
   1. Green: For cold-air supply ducts.
   2. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
   3. ASME A13.1 Colors and Designs: For hazardous material exhaust.
   4. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

B. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:
   1. Valve-Tag Size and Shape:
      a. Cold Water: 1-1/2 inches (38 mm), round.
      b. Hot Water: 1-1/2 inches (38 mm), round.
      c. Fire Protection: 2 inches (50 mm), round.

C. Valve-Tag Color:

a. Cold Water: Green.
b. Hot Water: Yellow.
c. Fire Protection: Red.

2. Letter Color:
a. Cold Water: White.
b. Hot Water: White.
c. Fire Protection: White.

3.6 VALVE-SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

3.7 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.8 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING & BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:
   1. Balancing airflow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
   2. Adjusting total HVAC systems to provide indicated quantities.
   3. Measuring electrical performance of HVAC equipment.
   4. Setting quantitative performance of HVAC equipment.
   5. Verifying that automatic control devices are functioning properly.
   6. Reporting results of the activities and procedures specified in this Section.

B. Related Sections include the following:
   1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
   2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

1.2 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.

C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

E. Report Forms: Test data sheets for recording test data in logical order.

F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

K. Test: A procedure to determine quantitative performance of a system or equipment.

L. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.

M. AABC: Associated Air Balance Council.
N. CTI: Cooling Tower Institute.
O. NEBB: National Environmental Balancing Bureau.
P. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.3 SUBMITTALS

A. Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.
B. Certified Testing, Adjusting, and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.
C. Warranty: Submit 2 copies of special warranty specified in the "Warranty" Article below.

1.4 QUALITY ASSURANCE

A. Agent Qualifications for larger projects: Engage a testing, adjusting, and balancing agent certified by AABC.
B. Agent Qualifications for smaller projects: Engage a testing, adjusting, and balancing agent certified by NEBB.
C. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:
    1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
    2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.
D. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC's "National Standards for Testing, Adjusting, and Balancing."
E. Testing, Adjusting, and Balancing Reports: Use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
F. Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards.
G. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
H. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.5 PROJECT CONDITIONS

A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.6 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.
B. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.
C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.7 WARRANTY

A. General Warranty: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.
   1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
   2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
B. Examine approved submittal data of HVAC systems and equipment.
C. Examine project record documents described in specifications.
D. Examine Architect's and Engineer's design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
E. Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
G. Examine system and equipment test reports.
H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
J. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
K. Examine terminal units, such as variable-air-volume boxes and mixing boxes, to verify that they are accessible and their controls are connected and functioning.
L. Examine equipment for installation and for properly operating safety interlocks and controls.
M. Examine automatic temperature system components to verify the following:
   1. Dampers, valves, and other controlled devices operate by the intended controller.
   2. Dampers and valves are in the position indicated by the controller.

3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
5. Sensors are located to sense only the intended conditions.
6. Sequence of operation for control modes is according to the Contract Documents.
7. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
8. Interlocked systems are operating.
9. Changeover from heating to cooling mode occurs according to design values.

N. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.2 PREPARATION

A. Complete system readiness checks and prepare system readiness reports. Verify the following:
1. Permanent electrical power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, fire dampers are open.
5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
6. Windows and doors can be closed so design conditions for system operations can be met.

3.3 GENERAL TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC national standards and this Section.

B. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

C. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.

D. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.4 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.
I. Check condensate drains for proper connections and functioning.
J. Check for proper sealing of air-handling unit components.

3.5 CONSTANT-VOLUME AIR SYSTEMS' BALANCING PROCEDURES

A. The procedures in this Article apply to constant-volume supply-, return-, and exhaust-air systems.
B. Adjust fans to deliver total design airflows within the maximum allowable rpm listed by the fan manufacturer.
   1. Measure fan static pressures to determine actual static pressure as follows:
      a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
      b. Measure static pressure directly at the fan outlet or through the flexible connection.
      c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
   2. Measure static pressure across each air-handling unit component.
      a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
   3. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
   4. Adjust fan speed higher or lower than design with the approval of the Architect. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
   5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure no overload will occur. Measure amperage in full cooling, full heating, and economizer modes to determine the maximum required brake horsepower.
C. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.
   1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
      a. Where sufficient space in submains and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
   2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submains and branch ducts to design airflows within specified tolerances.
D. Measure terminal outlets and inlets without making adjustments.
   1. Measure terminal outlets using a direct-reading hood or the outlet manufacturer's written instructions and calculating factors.
E. Adjust terminal outlets and inlets for each space to design airflows within specified tolerances of design values. Make adjustments using volume dampers rather than extractors and the dampers at the air terminals.
   1. Adjust each outlet in the same room or space to within specified tolerances of design quantities without generating noise levels above the limitations prescribed by the Contract Documents.

2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
   1. Manufacturer, model, and serial numbers.
   2. Motor horsepower rating.
   3. Motor rpm.
   4. Efficiency rating if high-efficiency motor.
   5. Nameplate and measured voltage, each phase.
   6. Nameplate and measured amperage, each phase.
   7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.7 CONDENSING UNITS

A. Verify proper rotation of fans and measure entering- and leaving-air temperatures. Record compressor data.

3.8 HEAT-TRANSFER COILS

A. Electric-Heating Coils: Measure the following data for each coil:
   1. Nameplate data.
   2. Airflow.
   3. Entering- and leaving-air temperatures at full load.
   4. Voltage and amperage input of each phase at full load and at each incremental stage.
   5. Calculated kW at full load.
   6. Fuse or circuit-breaker rating for overload protection.

3.9 TEMPERATURE TESTING

A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure outside-air, wet- and dry-bulb temperatures.

3.10 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Verify free travel and proper operation of control devices such as damper and valve operators.

F. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.

G. Confirm interaction of electrically operated switch transducers.

H. Confirm interaction of interlock and lockout systems.

I. Verify main control supply-air pressure and observe compressor and dryer operations.

J. Record voltages of power supply and controller output. Determine if the system operates on a grounded or nongrounded power supply.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.11 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:
   1. Supply and Exhaust Fans: Plus 5 to plus 10 percent.
   2. Air Outlets and Inlets: 0 to minus 10 percent.
   3. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.12 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.
B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
   1. Include a list of the instruments used for procedures, along with proof of calibration.
C. Final Report Contents: In addition to the certified field report data, include the following:
   1. Fan curves.
   2. Manufacturers' test data.
   3. Field test reports prepared by system and equipment installers.
   4. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.
D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
   1. Title page.
   2. Name and address of testing, adjusting, and balancing Agent.
   3. Project name.
   4. Project location.
   5. Architect's name and address.
   6. Engineer's name and address.
   7. Contractor's name and address.
   8. Report date.
   9. Signature of testing, adjusting, and balancing Agent who certifies the report.
   10. Summary of contents, including the following:
      a. Design versus final performance.
      b. Notable characteristics of systems.
      c. Description of system operation sequence if it varies from the Contract Documents.
   11. Nomenclature sheets for each item of equipment.
   12. Data for terminal units, including manufacturer, type size, and fittings.
   13. Notes to explain why certain final data in the body of reports vary from design values.
   14. Test conditions for fans and pump performance forms, including the following:
      a. Settings for outside-, return-, and exhaust-air dampers.
      b. Conditions of filters.
      c. Cooling coil, wet- and dry-bulb conditions.
      d. Face and bypass damper settings at coils.
      e. Fan drive settings, including settings and percentage of maximum pitch diameter.
      f. Settings for supply-air, static-pressure controller.
      g. Other system operating conditions that affect performance.
E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:

1. Quantities of outside, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.

F. Roof Top Unit Test Reports: For air-handling units with coils, include the following:
   1. Unit Data: Include the following:
      a. Unit identification.
      b. Location.
      c. Make and type.
      d. Model number and unit size.
      e. Manufacturer's serial number.
      f. Unit arrangement and class.
      g. Discharge arrangement.
      h. Sheave make, size in inches (mm), and bore.
      i. Number of belts, make, and size.
      j. Number of filters, type, and size.
   2. Motor Data: Include the following:
      a. Make and frame type and size.
      b. Horsepower and rpm.
      c. Volts, phase, and hertz.
      d. Full-load amperage and service factor.
   3. Test Data: Include design and actual values for the following:
      a. Total airflow rate in cfm (L/s).
      b. Total system static pressure in inches wg (Pa).
      c. Fan rpm.
      d. Discharge static pressure in inches wg (Pa).
      e. Preheat coil static-pressure differential in inches wg (Pa).
      f. Cooling coil static-pressure differential in inches wg (Pa).
      g. Heating coil static-pressure differential in inches wg (Pa).
      h. Outside airflow in cfm (L/s).
      i. Return airflow in cfm (L/s).
      j. Outside-air damper position.
      k. Return-air damper position.
      l. Discharge air temperature

G. Electric-Coil Test Reports: For electric duct coils, and electric coils installed in central-station air-handling units, include the following:
   1. Unit Data: Include the following:
      a. System identification.
      b. Location.
      c. Coil identification.
      d. Capacity in Btuh (kW).
      e. Number of stages.

f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Discharge air temperature

2. Test Data: Include design and actual values for the following:
a. Heat output in Btuh (kW).
b. Airflow rate in cfm (L/s).
c. Air velocity in fpm (m/s).
d. Entering-air temperature in deg F (deg C).
e. Leaving-air temperature in deg F (deg C).
f. Voltage at each connection.
g. Amperage for each phase.

H. Fan Test Reports: For exhaust fans, include the following:
1. Fan Data: Include the following:
a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
2. Motor Data: Include the following:
a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Number of belts, make, and size.
3. Test Data: Include design and actual values for the following:
a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Suction static pressure in inches wg (Pa).

I. Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, include the following:
1. Unit Data: Include the following:
a. Unit identification.
b. Location.
c. Unit make and model number.
d. Manufacturer's compressor serial numbers.
e. Compressor make.
f. Compressor model and serial numbers.
g. Refrigerant weight in lb (kg).
2. Test Data: Include design and actual values for the following:
a. Entering-air, dry-bulb temperature in deg F (deg C).
b. Leaving-air, dry-bulb temperature in deg F (deg C).

c. Control settings.
d. Unloader set points.
e. Low-pressure-cutout set point in psig (kPa).
f. High-pressure-cutout set point in psig (kPa).
g. Suction pressure in psig (kPa).
h. Suction temperature in deg F (deg C).
i. Condenser refrigerant pressure in psig (kPa).
j. Condenser refrigerant temperature in deg F (deg C).
k. Oil pressure in psig (kPa).
l. Oil temperature in deg F (deg C).
m. Voltage at each connection.
n. Amperage for each phase.
o. The kW input.
p. Number of fans.

3.13 ADDITIONAL TESTS

A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

END OF SECTION

SECTION 23 07 13

DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes semirigid and flexible duct, plenum, and breeching insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

1.2 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
   1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

B. Deliver and store all insulation with protective material until installation. Any material left exposed to moisture and/or particulates shall be removed and replaced.

C. Any installed insulation left temporarily incomplete shall be covered with protective material until final connections can be installed.

1.5 COORDINATION

A. Coordinate clearance requirements with duct Installer for insulation application.

1.6 SCHEDULING

A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Mineral-Fiber Insulation:
      a. CertainTeed Manson.
      b. Knauf FiberGlass GmbH.
      c. Owens-Corning Fiberglas Corp.
      d. Schuller International,Inc.

2.2 INSULATION MATERIALS

A. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film

2.3 Field Applied Jacket

A. Foil and paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

2.4 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).
   1. Tape Width: 4 inches (100 mm).
B. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.
   1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb (45 kg) for direct pull perpendicular to the adhered surface.

2.5 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.
B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.
C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
D. Apply multiple layers of insulation with longitudinal and end seams staggered.
E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
F. Keep insulation materials dry during application and finishing.
G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
H. Apply insulation with the least number of joints practical.
I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.
K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
L. Apply insulation with integral jackets as follows:
   1. Pull jacket tight and smooth.
   2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
   3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.
M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.
N. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.

1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.

O. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Seal insulation to roof flashing with vapor-retarder mastic.

P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

Q. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

R. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.
1. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.

3.4 MINERAL-FIBER INSULATION APPLICATION

A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.
1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
2. Install anchor pins and speed washers on sides and bottom of horizontal ducts and all sides of vertical ducts as follows:
a. On duct sides with dimensions 18 inches (450 mm) and smaller, along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
b. On duct sides with dimensions larger than 18 inches (450 mm). Space 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
3. Impale insulation over anchors and attach speed washers.
4. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
5. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch (13-mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.
6. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches (450 mm) o.c.
7. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round duct elbows with individually mitered gores cut to fit the elbow.
8. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch-(150-mm-) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150 mm) o.c.
9. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

3.5 DUCT SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.

C. Insulate the following plenums and duct systems:

1. Indoor concealed supply-, return-, and outside-air ductwork.
2. Indoor exposed supply-, return-, and outside-air ductwork.
3. Indoor concealed range-hood exhaust ductwork.
4. Indoor concealed dishwasher ductwork.

D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
1. Factory-insulated flexible ducts.
2. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
3. Flexible connectors.
4. Vibration-control devices.
5. Testing agency labels and stamps.
6. Nameplates and data plates.
7. Access panels and doors in air-distribution systems.

3.6 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

A. Service: Round and rectangular, supply-air ducts, concealed.
1. Material: Mineral-fiber blanket.
2. Thickness: 3 inches (R-8 or greater)
3. Number of Layers: One.
4. Field-Applied Jacket: Foil and paper.
5. Vapor Retarder Required: Yes.

B. Service: Round and rectangular, return-air ducts, outside air duct, concealed or exposed.
1. Material: Mineral-fiber blanket.
2. Thickness: 2 inches (50 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: Foil and Paper
5. Vapor Retarder Required: Yes.

C. Service: Round and rectangular, supply and return-air ducts, exposed and in mechanical rooms.
1. Material: 2" liner insulation
2. Thickness: 2 inches (50 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: No

D. Service: Round and rectangular, exhaust air ducts, concealed & exposed and in mechanical rooms.
1. Material: 1" Interior liner
2. Thickness: 1 inches
3. Number of Layers: One.
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: No

END OF SECTION

SECTION 23 08 00

COMMISSIONING HVAC SYSTEM

PART I - GENERAL

1.1 DESCRIPTION

A. Commissioning shall be done in accordance with ASHRAE 90.1, 6.7.2.4. System Commissioning and Guideline 0-2013

B. Commissioning of a system or systems specified in Division 23 is part of the construction process. Documentation and testing of these systems, as well as training of the owners Operation and Maintenance personnel in accordance with the requirements of Section 01 91 00 and of Division 23, is required in cooperation with the owner and the Commissioning Agent.

1.2 SUBMITTALS

A. The commissioning process requires review of selected Submittals that pertain to the systems to be commissioned. The Commissioning Agent will provide a list of submittals that will be reviewed by the project engineer. This list will be reviewed and approved by the Architect/Engineer prior to forwarding to the Contractor. Refer to Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, and SAMPLES for further details.

B. The commissioning process requires Submittal review simultaneously with engineering review. Specific submittal requirements related to the commissioning process are specified in Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

1.3 HEATING, VENTILATING, BUILDING AUTOMATION SYSTEMS (HVAC CONTROLS), AND TAB WORK

A. Provide at least 2 weeks' notice prior to manufacturer's check-test-start.

B. Provide duct leak test plan at least 2 weeks prior to each test

C. Provide 2 weeks' notice prior to functional testing, duct leak testing, and flushing and cleaning.

D. Provide 2 weeks' notice prior to each training session.

E. Fax or e-mail all notifications directly to the Commissioning Authority.

F. All required forms must be collected and provided for the Commissioning Binder by the contractor.

G. Provide brief agenda for each training session with the 2-week notification

H. Check, test, start and DEBUG all equipment before commissioning. If system "fails" commissioning or debugging becomes necessary during commissioning, commissioning shall be rescheduled.

I. Provide adequate maintenance clearance around all equipment or the equipment will "fail" commissioning.

J. Install all equipment per manufacturer's recommendations or the equipment will "fail" commissioning. If a conflict arises, mfg. versus specification requirements, ask before you install.

K. Do not schedule training until commissioning has been successful, all punch-list items relative to that system have been corrected, and all tests are completed and test results resolved.

L. Review and comply with the "O&M Check-List" before submitting draft O&M Manuals for review.

M. The commissioning tasks applicable to the mechanical, BAS and TAB work of Division 23 are as follows (all references apply to equipment to be commissioned only):

1. Construction and Acceptance Phase Requirements
    a. Submittal data, commissioning documentation, O&M data and training.

b. Attend all commissioning meetings.
c. Provide shop drawings of equipment to be commissioned along with completed & signed Pre-Functional checklists.
d. Document start-up and functional testing procedures including.
    1) Manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, Owner-contracted tests, fan and pump curves, all factory testing reports, and all warranty information.
    2) The Owner will require additional documentation necessary for LEED submittals if required by USGBC.
e. Table of Contents with listing of all equipment that will be included in the O&M manuals for review and approval.
f. Specific functional performance test procedures.
g. Alarm limits to be used during the tests.
h. Start-up and initial checkout plan using manufacturer's start-up procedures and the pre-functional checklists for all equipment to be commissioned. Submit to AE for review and approval prior to startup. Refer to *Section 01 91 13* for further details on start-up plan.
i. Prior to startup and initial checkout process, execute the mechanical prefunctional checklists for all equipment to be commissioned.
j. Perform and clearly document all system operational checkout procedures and completed startup, promptly providing a copy to the Owner as components are completed and systems are debugged and completed.
k. Correct all punch list items before functional testing.
l. Air and water TAB shall be completed with discrepancies and problems remedied before requesting Owner witnessing functional testing.
m. Functional Performance Tests / Procedures may be used to perform adjustments prior to witnessing by the AE and Owner.
n. Complete functional performance testing for specified equipment in Section 01 91 13. Assist the Owner in interpreting the monitoring data.
o. Correct deficiencies as interpreted by the *Cx Agent* and Engineer and retest the equipment prior to Functional Performance Witnessing by the CxA. Coordinate scheduling of Functional Performance Witnessing with the *Cx Agent* and Owner.
p. Provide all Documentation, Plans, Reports, Notes, Output from Electronic Commissioning Tools / other analysis tools to the Owner promptly upon successful Functional Test witnessing.
q. Update O&M manuals according to the Contract Documents.
r. Provide training of the Owner's operating staff.
s. Document specific requirements to maintain the validity of the warranty.

2. Warranty Period
    a. Execute seasonal or deferred functional performance testing, witnessed by the Owner.
    b. Correct deficiencies and make adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

1.4 HEATING AND VENTILATING WORK

A. Provide startup for all HVAC equipment, except for the BAS system.
B. Assist and cooperate with the TAB contractor and Owner by:

1. Include all HVAC equipment and systems into operation and continuing the operation during each working day of TAB and commissioning.
2. Include sheaves and belts that may be required by TAB.
3. Provide test holes in ducts and plenums where directed by TAB to allow air measurements and air balancing. Provide an approved plug.
4. Provide temperature and pressure taps according to the Construction Documents for TAB and commissioning testing.

C. Prepare a preliminary schedule for Division 23 pipe and duct system testing, flushing and cleaning, equipment start-up and TAB start and completion for use by the Owner. Update the schedule.

D. Notify the or Owner depending on protocol, when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and TAB will occur. Be responsible to notify the *Cx Agent* and Engineer, ahead of time, when commissioning activities not yet performed or not yet scheduled will delay construction. Be proactive in seeing that commissioning processes are executed, and that the Owner has the scheduling information needed to efficiently execute the commissioning process.

1.5 BAS(HVAC CONTROLS) WORK

A. Sequences of Operation Submittals. The BAS submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the specifications. They shall include:

1. An overview narrative of the system (1 or 2 paragraphs) generally describing its purpose, components and function.
2. All interactions and interlocks with other systems.
3. Detailed delineation of control between any packaged controls and the building automation system, listing what points the BAS monitors only and what BAS points are control points and are adjustable.
4. Written sequences of control for packaged controlled equipment. (Equipment manufacturers' stock sequences may be included, but will generally require additional narrative).
5. Start-up sequences.
6. Warm-up mode sequences.
7. Normal operating mode sequences.
8. Unoccupied mode sequences.
9. Shutdown sequences.
10. Capacity control sequences and equipment staging.
11. Temperature and pressure control: setbacks, setups, resets, etc.
12. Detailed sequences for all control strategies, e.g., economizer control, optimum start/stop, staging, optimization, demand limiting, etc.
13. Effects of power or equipment failure with all standby component functions.
14. Sequences for all alarms and emergency shut downs.
15. Seasonal operational differences and recommendations.
16. Initial and operational values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc., that will be useful during testing and operating the equipment.
17. Schedules, if known. (When ready to program, request Schedules from the AE if not already available).
18. To facilitate referencing in testing procedures, all sequences shall be written in small statements, each with a number for reference. For a given system, numbers will not repeat for different sequence sections, unless the sections are numbered.

19. Prior to Functional Performance Witnessing by the Owner, correct deficiencies as may be interpreted by the *Cx Agent* and Engineer and retest the equipment. Coordinate and confirm scheduling of Functional Performance Witnessing with the Cx *Agent* and Owner providing a pdf of successful trending as indication systems are ready for this procedural test phase.
20. Promptly provide all Documentation, Plans, Reports, Notes, Output from Electronic Commissioning Tools / other analysis tools to the Owner.

B. Control Drawings Submittal
   1. The control drawings shall have a key to all abbreviations.
   2. The control drawings shall contain graphic schematic depictions of the systems and each component.
   3. The schematics will include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
   4. Provide a full points list with at least the following included for each point:
      a. Controlled system
      b. Point abbreviation
      c. Point description
      d. Display unit
      e. Control point or setpoint
      f. Monitoring point
      g. Intermediate point
      h. Calculated point
      i. Point Description: DB temp, airflow, etc.
         1) Control or Setpoint: Point that controls equipment and can have its setpoint changed (OSA, SAT, etc.)
         2) Intermediate Point: Point whose value is used to make a calculation which then controls equipment (space temperatures that are averaged to a virtual point to control reset).
         3) Monitoring Point: Point that does not control or contribute to the control of equipment, but is used for operation, maintenance, or performance verification.
         4) Calculated Point: “Virtual” point generated from calculations of other point values.
      j. The Contractor shall keep the Owner informed of all changes to this list during programming and setup.

C. The Contractor shall prepare a written plan indicating in a step-by-step manner, the procedures that will be followed to test, checkout and adjust the control system prior to functional performance testing, including:
   1. System name.
   2. List of devices.
   3. Procedures for testing each controller after installation.
   4. A blank copy of the log and field checkout sheets that will document the process. This log must include a place for initial and final read values during calibration of each point and clearly indicate when a sensor or controller has “passed” and is operating within the contract parameters.
   5. A description of the instrumentation, if any, required for testing.
   6. Identify what tests on what systems must be completed for TAB work. Coordinate with the Owner and TAB contractor for this determination.

D. Assist the TAB contractor in the following manner:

1. Review the TAB plan to determine the capabilities of the building automation system toward completing TAB. Provide the TAB any needed unique instruments for setting terminal unit boxes and instruct TAB in their use (handheld control system interface for use around the building during TAB, etc.).
2. For a given area, have all required prefunctional checklists, calibrations, startup and selected functional tests of the system debugged, completed then approved by the Owner prior to TAB.
3. Provide a qualified technician to operate the controls during TAB, or provide sufficient training for TAB to operate the system without assistance.
4. Provide an all points report (digital) validating commands and responses with calibrated data matching and validating the required data / Report from the TAB.

E. Provide a signed and dated certification to the *Cx Agent* and Engineer upon completion of the checkout for all controlled devices, equipment and systems prior to functional testing for each piece of equipment or system, that all system programming is complete as to all respects of the Contract Documents, except functional testing requirements.

F. Assist and cooperate with the Owner in the following manner:

G. In addition to the control points necessary to execute all control sequences, provide monitoring, control and virtual points as required in the Contract Documents.

H. Prior to Functional Performance Witnessing by the Owner, correct deficiencies as may be interpreted by the *Cx Agent* and Engineer to retest the equipment. Coordinate and confirm scheduling of Functional Performance Witnessing with the Cx Agent and Owner.

I. Promptly provide all Documentation, Reports, Notes, Output from Electronic Commissioning Tools / other analysis tools to the Owner.

J. List and clearly identify on the as-built duct and piping drawings, the locations of all static and differential pressure sensors (air, water and building pressure).

K. An updated as-built version of the control drawings and sequences of operation shall be included in the final BAS O&M manual submittal.

1.6 TAB WORK

A. Prior to starting TAB, submit to the *Engineer* the qualifications of the site technician for the project, including the name and contact information of the contractors and facility managers of recent projects the technician on which was lead. The Owner shall approve the site technician's qualifications for this project.

B. A running log of events and issues shall be kept by the TAB field technicians. Discrepancies, deficiencies or uncompleted work by others, contract interpretation requests and lists of completed tests shall be provided to the Owner and *Cx Agent* and Engineer prior to Witness Phase of Functional Testing.

C. Communicate in writing or during recorded meetings with the *Cx Agent* and Engineer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect the control system setup and operation.

D. Provide a Preliminary TAB report within two weeks of completion. A copy will be provided to the Owner. The report will contain a sumary explanation of the assumptions and the results in a clear format with designations of all uncommon abbreviations and column headings. The report should follow the latest and most rigorous reporting recommendations by AABC or NEBB.

E. Provide the Owner with any requested data, gathered in accordance with the Project, but not shown on the draft reports as necessary to satisfy USGBC reporting.

F. Conduct spot checks on all performed balancing for witness by the Owner.

G. Provide a final electronic TAB report organized in accordance with Project requirements with details. Include all documentation previously identified and / or requested.

1.7 RELATED WORK

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

PART 3 - EXECUTION

3.1 CONSTRUCTION INSPECTIONS

A. Commissioning of HVAC systems will require inspection of individual elements of the HVAC systems construction throughout the construction period. The Contractor shall coordinate with the Commissioning Agent in accordance with Section 01 19 00 and the Commissioning plan to schedule HVAC systems inspections as required to support the Commissioning Process.

3.2 STARTUP

A. The Heating, Ventilating and BAS Work shall clarify start-up responsibility and requirements to complete systems and sub-systems so they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the Owner.

B. Work shall identify responsibility for calibrating all control sensors and equipment.

3.3 CONTRACTOR TESTS

A. Contractors shall forward to the Owner, through the *[CM/GC]*, a list and schedule of specified contractor tests. The tests shall include at least the following:

Ductwork	Ductwork Testing
AHU's	Startup
Dedicated Outside Air Unit	Startup
Controls	Preparation (calibration)

B. Unless specified otherwise, provide a minimum 2 week prior notice to the Owner through the General Contractor for each specified Contractors' test.

C. Submit Contractors' test reports to the Owner, through the *General Contractor* within one week of the successful completion of each test. Contractors shall document and issue a test report for each required test. Individual test reports should be bundled together into a group for submission to the Owner. The test report shall contain all information required by the respective specification section including the test date, start time, stop time, test duration, initial values, final values, expected result, and acceptable test values (per individual specification sections). The person(s) conducting each test and the local code authority (if applicable) shall sign and date each test report indicating that the test has been successfully completed and the results are within acceptable parameters.

3.4 FUNCTIONAL PERFORMANCE (WITNESSED) TESTS

A. All checkouts, coordination with other Contractors, Work, debugging, preliminary reports including validating coordinated work with BAS, Vent and Heating Contractors shall all have been completed prior to requesting scheduling of Owner witnessing of Functional Testing Procedures.

3.5 TESTING DOCUMENTATION, NON-CONFORMANCE AND APPROVALS

3.6 OPERATION AND MAINTENANCE (O&M) MANUALS

A. The following O&M manual requirements do not replace O&M manual documentation requirements elsewhere in these specifications. Refer to *Section 01 78 23 – Operation and Maintenance Data* and *Section 01 91 13 – General Commissioning Requirements* for additional O&M manual requirements.
B. Additional BAS O&M Manual Requirements. In addition to documentation that may be specified elsewhere, the BAS Contractor shall compile and organize at minimum the following data on the control system in labeled three-ring binders with indexed tabs.
   1. Three copies of the controls training manuals.
   2. The O&M manual shall be organized and subdivided with permanently labeled tabs for each of the following data in the given order:
      a. Sequences of operation
      b. Control drawings
      c. Points lists
      d. Controller/module data
      e. Thermostats and timers
      f. Sensors and DP switches
      g. Valves and valve actuators
      h. Dampers and damper actuators
      i. Program setups (software program printouts)
   3. Operation and Maintenance Manuals content:
      a. Specific instructions on how to perform and apply all functions, features, modes, etc., mentioned in the controls training sections of this specification and other features of this system. These instructions shall be step-by-step. Indexes and clear tables of contents shall be included. The detailed technical manual for programming and customizing control loops and algorithms shall be included.
      b. Full as-built set of control drawings (refer to Submittal section above for details).
      c. Full as-built sequence of operations for each piece of equipment.
      d. Full points list.
      e. Full print out of all schedules and set points after testing and acceptance of the system.
      f. Full as-built print out of software program.
      g. Electronic copy on disk of the entire program for this facility.
      h. Marking of all system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.
      i. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
      j. Control equipment component submittals, parts lists, etc.
      k. Warranty requirements.
      l. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
   4. Field checkout sheets shall be provided to the Owner for inclusion in the Commissioning Record Book (merged with Systems Manual).
C. Review and Approvals. Review of the commissioning related sections of the O&M manuals shall be made by the Owner. Refer to *Section 01 91 13*.

3.7 TRAINING OF OWNER PERSONNEL

A. The *General Contractor* shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed. Refer to *Section 01 91 13*.
B. The Heating and Ventilating Contractors shall have the following additional training responsibilities:
   1. Provide the designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of mechanical equipment (pumps, airflow stations, air handling units, fans, cabinet heaters, and controls).
   2. Training shall normally start with discussion sessions followed by hands-on training on each piece of equipment, which shall illustrate the various modes of operation, including startup, shutdown, fire/smoke alarm, power failure, etc.
   3. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
   4. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise and in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
   5. The Contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.
   6. The training sessions shall follow the outline in the table of contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
   7. Training shall include:
      a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
      b. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include start-up, operation in all modes possible, shut-down, seasonal changeover and any emergency procedures.
      c. Discussion of relevant health and safety issues and concerns.
      d. Discussion of warranties and guarantees.
      e. Common troubleshooting problems and solutions.
      f. Explanatory information included in the O&M manuals and the location of all plans and manuals in the facility.
      g. Discussion of any peculiarities of equipment installation or operation.
   8. Hands-on training shall include start-up, operation in all modes possible, including manual, shut-down and any emergency procedures and preventative maintenance for all pieces of equipment.
   9. The Contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls, not *controlled* by the central building automation system.
   10. Training shall occur after functional testing is complete, unless approved otherwise by the Owner.
   11. Duration of Training. The contractor shall provide training on each piece of equipment.
C. The Heating Contractor shall have the following additional training responsibilities:
   1. The Contractor shall provide the designated Owner personnel training on the building automation system in this facility. The intent is to clearly and completely instruct the Owner on all the capabilities of the building automation system.

2. Training manuals. The standard operating manual for the system and any special training manuals will be provided for each trainee, with three extra copies left for the O&M manuals. In addition, copies of the system technical manual will be demonstrated during training and three copies submitted with the O&M manuals. Manuals shall include detailed description of the subject matter for each session. The manuals will cover all control sequences and have a definitions section that fully describes all relevant words used in the manuals *and* in all software displays. Manuals will be approved by the Owner. Copies of audiovisuals shall be delivered to the Owner.
3. The training will be tailored to the needs and skill-level of the trainees.
4. The trainers will be knowledgeable on the system and its use in buildings. The Owner shall approve the instructor prior to scheduling the training.
5. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
6. Duration of Training. The Contractor shall provide training on each piece of equipment.

3.8 WRITTEN WORK PRODUCTS

A. Written work products of Contractors will consist of the start-up and initial checkout plan, all other Plans, Contractor Tests, the filled out Start-up, all Checkouts such as but not limited to Pre-Functional Checklists, BAS and TAB (trend proofs, I/O value reports logs), Preliminary TAB and Final TAB Reports described herein and in *Section 01 91 00.*

END OF SECTION

SECTION 23 09 23

DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

PART 1- GENERAL

1.1 DESCRIPTION

A. General: The control system shall consist of a high-speed, peer-to-peer network of DDC controllers, a control system server, and a web-based operator interface.

B. System software shall be based on a server/thin client architecture, designed around the open standards of web technology. The control system server shall be accessed using a Web browser over the control system network, the owner's local area network, and (at the owner's discretion) over the Internet.
The intent of the thin-client architecture is to provide operators complete access to the control system via a Web browser. No special software other than a web browser shall be required to access graphics, point displays, and trends, configure trends, configure points and controllers, or to download programming into the controllers.

C. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules. I/O points, schedules, setpoints, trends and alarms specified in Sequence of Operations for HVAC Controls" shall be BACnet objects.

D.

1.2 APPROVED CONTROL SYSTEM MANUFACTURERS

A. The following are approved control system suppliers, manufacturers, and product lines:

Supplier	Manufacturer	Product Line
JCI – Branch Office	Tridium N4	Niagra
Climatec	Tridium N4	Niagra

1.3 QUALITY ASSURANCE

A. Installer and Manufacturer Qualifications
1. Installer shall have an established working relationship with Control System Manufacturer.
2. Installer shall have successfully completed Control System Manufacturer's control system training. Upon request, Installer shall present record of completed training including course outlines.

1.4 ARCHITECTURE/COMMUNICATION

A. System architecture shall consist of no more than two levels of LANs.
1. Level one LAN shall connect network controllers and operator workstations.
2. Level two LAN shall connect programmable application controllers to other programmable application controllers, and to network controllers.
3. Level two LAN shall connect application-specific controllers to programmable application controllers and network controllers.

4. Level two LAN shall connect application-specific controllers to application-specific controllers.

B. DDC system shall consist of dedicated and separated LANs that are not shared with other building systems and tenant data and communication networks.

C. System architecture shall be modular and have inherent ability to expand to not less than two times system size indicated with no impact to performance indicated.

D. System architecture shall perform modifications without having to remove and replace existing network equipment.

E. Number of LANs and associated communication shall be transparent to operator. All I/O points residing on any LAN shall be capable of global sharing between all system LANs.

F. System design shall eliminate dependence on any single device for system alarm reporting and control execution. Each controller shall operate independently by performing its' own control, alarm management and historical data collection.

G. Special Network Architecture Requirements:

1. Air-Handling Systems: For control applications of an air-handling system that consists of air-handling unit(s) and VAV terminal units, include a dedicated LAN of application-specific controllers serving VAV terminal units connected directly to controller that is controlling air-handling system air-handling unit(s). Basically, create a DDC system LAN that aligns with air-handling system being controlled.

1.5 GRAPHICS PACKAGE

A. All floor plan graphics shall be represented in a 3D extruded wall thermograph.

B. All equipment graphics shall by 3D representations of actual equipment at site.

1.6 CODES AND STANDARDS

A. Work, materials, and equipment shall comply with the most restrictive of local, state, and federal authorities' codes and ordinances or these plans and specifications. As a minimum, the installation shall comply with the current editions in effect 30 days prior to the receipt of bids of the following codes:

1. ANSI/ASHRAE Standard 135, BACnet - A Data Communication Protocol for Building Automation and Control Systems

B. Schedules:

1. Within one month of contract award, provide a schedule of the work indicating the following:
   a. Intended sequence of work items
   b. Start date of each work item
   c. Duration of each work item
   d. Planned delivery dates for ordered material and equipment and expected lead times
   e. Milestones indicating possible restraints on work by other trades or situations.
2. Monthly written status reports indicating work completed and revisions to expected delivery dates. Include updated schedule of work.
3.

1.7 WARRANTY

A. Warrant work as follows:

1. Warrant labor and materials for specified control system free from defects for a period of 12 months after final acceptance. Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner’s warranty service request.

2. Work shall have a single warranty date, even if Owner receives beneficial use due to early system start-up. If specified work is split into multiple contracts or a multi-phase contract, each contract or phase shall have a separate warranty start date and period.
3. If the engineer determines that equipment and systems operate satisfactorily at the end of final start-up, testing, and commissioning phase, the engineer will certify in writing that control system operation has been tested and accepted in accordance with the terms of this specification. Date of acceptance shall begin warranty period.
4. Provide updates to operator workstation or web server software, project-specific software, graphic software, database software, and firmware that resolve the contractor-identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with above-mentioned items. Do not install updates or upgrades without Owner's written authorization.
5. Exception: Contractor shall not be required to warrant reused devices except those that have been rebuilt or repaired. Installation labor and materials shall be warranted. Demonstrate operable condition of reused devices at time of Engineer's acceptance.
6.

1.8 OWNERSHIP OF PROPRIETARY MATERIAL

A. Project-specific software and documentation shall become Owner's property. This includes, but is not limited to:
   1. Graphics
   2. Record drawings
   3. Database
   4. Application programming code
   5. Documentation

1.8 TRAINING

A. Provide training for a designated staff of Owner's representatives in two four hour sesions. Training shall be provided via web-based or computer-based training, classroom training, or a combination of training methods.
B. Training shall enable students to accomplish the following objectives.
   1. Day-to-day Operators:
      a. Proficiently operate the system
      b. Understand control system architecture and configuration
      c. Understand DDC system components
      d. Understand system operation, including DDC system control and optimizing routines (algorithms)
      e. Operate the workstation and peripherals
      f. Log on and off the system
      g. Access graphics, point reports, and logs
      h. Adjust and change system set points, time schedules, and holiday schedules
      i. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals
      j. Understand system drawings and Operation and Maintenance manual
      k. Understand the job layout and location of control components
      l. Access data from DDC controllers and ASCs
      m. Operate portable operator's terminals

PART -2 SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

2.1 SECTION INCLUDES:

A. Rooftop Units
B. Variable Air Volume

C. DX Single Zone Unit
D. Exhaust Fan
E. Motorized Dampers
F. Lighting Controls via BACnet (Alternate)

2.2 ROOFTOP UNITS (RTU-A1 thru C3)

Building Automation System Interface:
The Building Automation System (BAS) shall send the controller Occupied Bypass, Pre-Cool, Occupied / Unoccupied and Heat / Cool modes. If a BAS is not present, or communication is lost with the BAS the RTU controller shall operate using default modes and setpoints.
Occupied Mode:
During occupied periods, the supply fan shall run continuously and the outside air damper shall open to maintain minimum ventilation requirements. The unit controller shall control the supply fan VFD to maintain the current duct static pressure setpoint (adj.).The DX cooling shall stage to maintain the current discharge air temperature setpoint. If economizing is enabled the outside air damper shall modulate to maintain the current discharge air temperature setpoint.
Unoccupied Mode:
When the space temperature is above the unoccupied cooling setpoint of 85.0 deg. F (adj.) the supply fan variable frequency drive (VFD) shall operate as necessary to maintain duct static pressure setpoint (adj.), the outside air damper shall open if economizing is enabled and remain closed if economizing is disabled and the DX cooling shall be enabled. When the space temperature falls below the unoccupied cooling setpoint of 85.0 deg. F minus the unoccupied differential of 4.0 deg. F (adj.) the supply fan shall stop, the DX cooling shall be disabled and the outside air damper shall close.
Optimal Start:
The BAS shall monitor the scheduled occupied time, occupied space setpoints and space temperature to calculate when the optimal start occurs.
Pre-Cool Mode:
During optimal start, if the average space temperature is above the occupied cooling setpoint, pre-cool mode shall be activated. When pre-cool is initiated the unit shall enable the fan and cooling or economizer. The outside air damper shall remain closed, unless economizing. When the average space temperature reaches occupied cooling setpoint (adj.), the unit shall transition to the occupied mode.
Optimal Stop:
The BAS shall monitor the scheduled unoccupied time, occupied setpoints and space temperature to calculate when the optimal stop occurs. When the optimal stop mode is active the unit controller shall maintain the space temperature to the space temperature offset setpoint.
Occupied Bypass:
The BAS shall monitor the status of the “on” and “cancel” buttons of the space temperature sensors. When an occupied bypass request is received from a space sensor, the unit shall transition from its current occupancy mode to occupied bypass mode and the unit shall maintain the space temperature to the occupied setpoints (adj.).
Cooling Mode:
The unit controller shall use the discharge air temperature sensor and discharge air temperature cooling setpoint to determine when to initiate requests for cooling. Discharge air setpoint shall be maintained by modulating the economizer or staging the DX cooling as required to maintain the discharge air setpoint.
Supply Air Temperature Reset Control:
The discharge air temperature setpoint, 55.0 deg. F - 65.0 deg. F (adj.) shall be reset based on either the outside air temperature or space average temperature (adj.). The minimum discharge air setpoint shall

be set at 55.0 deg. F (adj.). The discharge temperature sensor shall prevent the discharge air temperature from falling below the minimum discharge air setpoint (adj.). If the discharge air temperature continues to fall, the discharge temperature sensor shall act as a low discharge temperature limit, a low temperature alarm shall be annunciated, and the unit shall shut down. If the discharge temperature rises above the high limit setpoint the sensor shall act as a high discharge temperature limit and shall keep the unit running, a high temperature alarm shall be annunciated.

Outdoor Air Temperature Reset:
The discharge air temperature setpoint shall be adjusted based on the outside air temperature and the cooling load of the building.

Space Temperature Reset:
The discharge air temperature setpoint shall be adjusted based on the temperature of the critical space(s).

Economizer:
The supply air sensor shall measures the dry bulb temperature of the air leaving the evaporator coil while economizing. When economizing is enabled and the unit is operating in the cooling mode, the economizer damper shall be modulated between its minimum position and 100% to maintain the discharge air temperature setpoint. The economizer damper shall modulate toward minimum position in the event the mixed air temperature falls below the low limit temperature setting. Compressors shall be delayed from operating until the economizer has opened to 100%.

Supply Fan:
The supply fan shall be enabled while in the occupied mode and cycled on during the unoccupied mode. A differential pressure switch shall monitor the differential pressure across the fan. If the switch does not open within 40 seconds after a request for fan operation a fan failure alarm shall be annunciated at the BAS, the unit shall stop, requiring a manual reset.

Critical Zone Reset (Static Pressure Control):
The duct static pressure setpoint shall be reset to the optimal setpoint communicated by the BAS. The BAS shall reset the duct static pressure setpoint based on the position of the furthest open VAV damper. The supply duct static pressure sensor shall also act as a high duct static pressure safety and shall shut down the unit in the event that the duct static pressure reaches 3.00 inches of W.C. (adj.). A manual reset shall be required to re-start the unit. When the unit is in the unoccupied mode the controller shall modulate the speed of the VFD to 50%. If the duct static pressure sensor fails, the VFD shall modulate its speed to 50% and an alarm shall be annunciated at the BAS.

Filter Status:
A differential pressure switch shall monitor the differential pressure across the filter when the fan is running. If the switch closes for 2 minutes after a request for fan operation a dirty filter alarm shall be annunciated at the BAS.

2.3 NA

2.5 DX SINGLE ZONE UNIT

Run Conditions – Scheduled through BAS:
The unit shall be controlled using a BACnet communicating thermostat.
Alarms shall be provided as follows:

Zone Setpoint Adjust:
The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.

The supply fan shall run anytime the unit is commanded to run, unless shutdown on internal safeties.

Cooling Stages:

The controller shall measure the zone temperature and stage the cooling to maintain its cooling setpoint.

Electric Heating Stages:

The controller shall measure the zone temperature and stage the heating to maintain its heating setpoint.

2.6 MISCELLANEOUS CONTROL POINTS

Outdoor Air Temperature and Humidity:

A temperature and humidity sensor mounted on the north side of the building will continually broadcast their information on the network as global information

Building Exhaust Fan:

When any RTU is active the BAS will energize the exhaust fan. The exhaust fan will be off when the RTU is inactive.

Temperature monitor of elevator equipment room served by minisplits. Alarms shall be provided as follows:

High Temp: When temp is above user defined setpoint an alarm will be initiated.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:

1. Furnish and install piping and specialties for refrigeration systems as described in Contract Documents.

B. Products Installed But Not Furnished Under This Section:

1.2 REFERENCES

A. Association Publications:

1. Federal Emergency Management Agency (FEMA) / Vibration Isolation and Seismic Control Manufacturers Association (VISCMA) / American Society of Civil Engineers (ASCE):
   a. FEMA 412, 'Installing Seismic Restraints For Mechanical Equipment' (December 2002).
2. Vibration Isolation and Seismic Control Manufacturers Association (VISCMA):
   a. VISCMA 101-12, 'Seismic Restraint Specification Guidelines for Mechanical, Electrical, and Plumbing Systems'.
   b. VISCMA 102-12, 'Vibration Isolation Specification Guidelines for Mechanical, Electrical, and Plumbing Systems'.

B. Definitions:

1. Refrigerant: Absorbs heat by a change of state (evaporation) from liquid to a gas, and releases heat by a change of state (condenses) from gas back to a liquid.
2. Vibration Isolation: Vibration reduction in which an isolation system is placed between the source of unwanted vibration and an item which needs to be shielded from the vibration.

C. Reference Standards:

1. American National Standards Institute (ANSI) / American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
   a. ANSI/ASHRAE Standard 15-2010, 'Safety Standard for Refrigeration Systems'.
   b. ANSI/ASHRAE Standard 34-2010, 'Designation and Classification of Refrigerants'.
2. American National Standards Institute / American Welding Society:
   a. ANSI/AWS A5.8M/A5.8-2011, 'Specification for Filler Metals for Brazing and Braze Welding'.
3. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
   a. '2011 ASHRAE Handbook - HVAC Applications'.
      1) Chapter 48, 'Noise and Vibration Control'.
4. ASTM International:
   a. ASTM A36/A36M-08, 'Standard Specification for Carbon Structural Steel'.
   b. ASTM B280-08, 'Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service'.
5. National Fire Protection Association / American National Standards Institute:

a. NFPA 90A-2012, 'Installation of Air Conditioning and Ventilating Systems'.

6. Underwriters Laboratories:
   a. UL 2182, 'Refrigerants' (2nd Edition).

1.3 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings: Show each individual equipment and piping support.

B. Informational Submittals:
   1. Qualification Statements: Technician certificate for use of HFC and HCFC refrigerants.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Refrigerants:
      a. Underwriters Laboratories / Underwriters Laboratories of Canada:
         1) Comply with requirements of UL 2182.

B. Qualifications. Section 01 4301 applies, but is not limited to the following:
   1. Installer: Refrigerant piping shall be installed by refrigeration contractor licensed by State and by technicians certified in use of HFC and HCFC refrigerants.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Manufacturers:
   1. Manufacturer Contact List:
      a. Airtec,
      b. Cush-A-Clamp by ZSI Manufacturing,
      c. Elkhart Products Corp,.
      d. Emerson Climate Technologies,
      e. Handy & Harman Products
      f. Harris Products Group,
      g. Henry Valve Co,
      h. Hilti Inc,
      i. Hydra-Zorb Co,
      j. JB Industries,
      k. Mueller Steam Specialty,
      l. Nibco Inc,
      m. Packless Industries, Parker Corp,
      n. Sporlan Valve Co.
      o. Sherwood Valves,.
      p. Thomas & Betts,
      q. Unistrut, Div of Atkore International, Inc.
      r. Universal Metal Hose.
      s. Vibration Mountings & Controls,
      t. Virginia KMP Corp,

B. Materials:
   1. Refrigerant Piping:
      a. Meet requirements of ASTM B280, hard drawn straight lengths. Soft copper tubing not permitted.
      b. Do not use pre-charged refrigerant lines.

2. Refrigerant Fittings:
   a. Wrought copper with long radius elbows.
   b. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
      1) Mueller Streamline.
      2) Nibco Inc.
      3) Elkhart.
3. Suction Line Traps:
   a. Manufactured standard one-piece traps.
   b. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
      1) Mueller Streamline.
      2) Nibco Inc.
      3) Elkhart.
4. Tee Access:
   a. Brass:
      1) Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
         a) JB Industries: Part #A3 Series with Factory Cap and Valve Core.
5. Connection Material:
   a. Brazing Rods in accordance with ANSI/AWS A5.8M/A5.8:
      1) Copper to Copper Connections:
         a) Classification BCuP-4 Copper Phosphorus (6 percent silver).
         b) Classification BCuP-5 Copper Phosphorus (15 percent silver).
      2) Copper to Brass or Copper to Steel Connections: Classification BAg-5 Silver (45 percent silver).
      3) Do not use rods containing Cadmium.
   b. Flux:
      1) Type Two Acceptable Products:
         a) Stay-Silv White Brazing Flux by Harris Products Group.
         b) High quality silver solder flux by Handy & Harmon.
         c) Equal as approved by Architect before use. See Section 01 6200.
6. Valves:
   a. Expansion Valves:
      1) For pressure type distributors, externally equalized with stainless steel diaphragm, and same refrigerant in thermostatic elements as in system.
      2) Size valves to provide full rated capacity of cooling coil served. Coordinate selection with evaporator coil and condensing unit.
      3) Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
         a) Emerson Climate Technologies.
         b) Henry.
         c) Mueller.
         d) Parker.
         e) Sporlan.
   b. Manual Refrigerant Shut-Off Valves:
      1) Ball valves designed for refrigeration service and full line size.
      2) Valve shall have cap seals.

3) Valves with hand wheels are not acceptable.
4) Provide service valve on each liquid and suction line at compressor.
5) If service valves come as integral part of condensing unit, additional service valves shall not be required.
6) Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
   a) Henry.
   b) Mueller.
   c) Sherwood.
   d) Virginia.

7. Filter-Drier:
   a. On lines 3/4 inch (19 mm) outside diameter and larger, filter-drier shall be replaceable core type with Schraeder type valve.
   b. On lines smaller than 3/4 inch (19 mm) outside diameter, filter-drier shall be sealed type with brazed end connections.
   c. Size shall be full line size.
   d. Category Four Approved Manufacturers. See Section 01 6200 for definitions of Categories:
      1) Emerson Climate Technologies.
      2) Mueller.
      3) Parker.
      4) Sporlan.
      5) Virginia.
8. Sight Glass:
   a. Combination moisture and liquid indicator with protection cap.
   b. Sight glass shall be full line size.
   c. Sight glass connections and sight glass body shall be solid copper or brass, no copper-coated steel sight glasses allowed.
   d. Category Four Approved Product. See Section 01 6200 for definitions of Categories:
      1) HMI by Emerson Climate Technologies.
9. Flexible Connectors:
   a. Designed for refrigerant service with bronze seamless corrugated hose and bronze braiding.
   b. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) Vibration Absorber Model VAF by Packless Industries.
      2) Vibration Absorbers by Virginia KMP Corp.
      3) Anaconda 'Vibration Eliminators' by Universal Metal Hose.
      4) Style 'BF' Spring-flex freon connectors by Vibration Mountings.
10. Refrigerant Piping Supports:
   a. Base, Angles, And Uprights: Steel meeting requirements of ASTM A36.
   b. Securing Channels:
      1) At Free-Standing Pipe Support:
         a) Class One Quality Standard: P-1000 channels by Unistrut.
         b) Acceptable Manufacturers: Hilti, Thomas & Betts.
         c) Equal as approved by Architect before installation. See Section 01 6200.
      2) At Wall Support:
         a) Class One Quality Standard: P-3300 channels by Unistrut.

b) Acceptable Manufacturers: Hilti, Thomas & Betts.
c) Equal as approved by Architect before installation. See Section 01 6200.

3) At Suspended Support:
a) Class One Quality Standard: P-1001 channels by Unistrut.
b) Acceptable Manufacturers: Hilti, Thomas & Betts.
c) Equal as approved by Architect before installation. See Section 01 6200.

4) Angle Fittings:
a) Class One Quality Standard: P-2626 90 degree angle by Unistrut.
b) Acceptable Manufacturers: Hilti, Thomas & Betts.
c) Equal as approved by Architect before installation. See Section 01 6200.

c. Pipe Clamps:
1) Type Two Acceptable Manufacturers:
a) Hydra-Zorb.
b) ZSI Cush-A-Clamp.
c) Hilti Cush-A-Clamp.
d) Equal as approved by Architect before installation. See Section 01 6200.

d. Protective Cover: 18 ga (1.2 mm) steel, hot-dipped galvanized.

11. Locking Refrigerant Cap:
a. Provide and install on charging valves:
1) Class One Quality Standard: 'No Vent' locking refrigerant cap.
2) Acceptable Manufacturers: Airtec.
3) Equal as approved by Architect before installation. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refrigerant Lines:
1. Install as high in upper mechanical areas as possible. Do not install underground or in tunnels.
2. Slope suction lines down toward compressor one inch/10 feet (25 mm in 3 meters). Locate traps at vertical rises against flow in suction lines.

B. Connections:
1. Refrigeration system connections shall be copper-to-copper, copper-to-brass, or copper-to-steel type properly cleaned and brazed with specified rods. Use flux only where necessary. No soft solder (tin, lead, antimony) connections will be allowed in system.
2. Braze manual refrigerant shut-off valve, sight glass, and flexible connections.
3. Circulate dry nitrogen through tubes being brazed to eliminate formation of copper oxide during brazing operation.

C. Specialties:
1. Install valves and specialties in accessible locations. Install refrigeration distributors and suction outlet at same end of coil.
2. Install thermostatic bulb as close to cooling coil as possible. Do not install on vertical lines.
3. Install equalizing line in straight section of suction line, downstream of and reasonably close to thermostatic bulb. Do not install on vertical lines.
4. Provide flexible connectors in each liquid line and suction line at both condensing unit and evaporator on systems larger than five tons. Anchor pipe near each flexible connector.

D. Refrigerant Supports:

1. Support Spacing:
   a. Piping 1-1/4 inch (32 mm) And Larger: 8 feet (2.450 m) on center maximum.
   b. Piping 1-1/8 inch (28.5 mm) And Smaller: 6 feet (1.80 m) on center maximum.
   c. Support each elbow.
2. Isolate pipe from supports and clamps with Hydrozorb or Cush-A-Clamp systems.
3. Run protective cover continuous from condensing units to risers or penetrations at building wall.

3.2 FIELD QUALITY CONTROL

A. Field Tests:
   1. Make evacuation and leak tests in presence of Architect's Engineer after completing refrigeration piping systems. Positive pressure test will not suffice for procedure outlined below.
      a. Draw vacuum on each entire system with two stage vacuum pump. Draw vacuum to 300 microns using micron vacuum gauge capable of reading from atmosphere to 10 microns. Do not use cooling compressor to evacuate system nor operate it while system is under high vacuum.
      b. Break vacuum with nitrogen and re-establish vacuum test. Vacuum shall hold for 30 minutes at 300 microns without vacuum pump running.
      c. Conduct tests at 70 deg F (21 deg C) ambient temperature minimum.
      d. Do not run systems until above tests have been made and systems started up as specified. Inform Owner's Representative of status of systems at time of final inspection and schedule start-up and testing if prevented by outdoor conditions before this time.
      e. After testing, fully charge system with refrigerant and conduct test with Halide Leak Detector.
      f. Recover all refrigerant in accordance with applicable codes. Do not allow any refrigerant to escape to atmosphere.

B. Non-Conforming Work:
   1. If it is observed that refrigerant lines are being or have been brazed without proper circulation of nitrogen through lines, all refrigerant lines installed up to that point in time shall be removed and replaced at no additional cost to Owner.

END OF SECTION

SECTION 23 26 00

CONDENSATE DRAIN PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:

1. Coordinate installation of condensate drain piping with Section 22 0501 as described in Contract Documents.

1.2 REFERENCES

A. Reference Standards:

1. ASTM International:

a. ASTM B88-09, 'Standard Specification for Seamless Copper Water Tube'.

b. ASTM D1785-12, 'Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120'.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Materials:

1. Condensate Drains:

a. Exterior And Interior Lines: Type M copper meeting requirements of ASTM B88.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Condensate Drains:

1. Support piping and protect from damage.

END OF SECTION

SECTION 23 31 13

METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions.

1.2 SUMMARY

B. This Section includes rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air-conditioning systems in pressure classes from minus 2- to plus 10-inch wg

1.3 DEFINITIONS

A. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C 168. In this Section, these values are the result of the formula Btu x in./h x sq. ft. x deg F or W/m x K at the temperature differences specified. Values are expressed as Btu or W.

1.4 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select and size air-moving and -distribution equipment and other components of air system. Changes to layout or configuration of duct system must be specifically approved in writing by Architect.

1.5 SUBMITTALS

A. Product Data: For duct liner and sealing materials.

B. Shop Drawings: Show details of the following:

1. Duct layout indicating pressure classifications and sizes on plans.
2. Fittings.
3. Penetrations through fire-rated and other partitions.
4. Coordination with other trades and including but not limited to: structural members, electrical lights and conduits, plumbing lines, & fire sprinkler lines.

C. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling- and wall-mounted access doors and panels required to provide access to dampers and other operating devices.
2. Coordination with ceiling-mounted items, including lighting fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.

D. Duct Construction Standards: Provide a copy of the duct construction standards to be used for each pressure classification in this project. Duct Construction Standards must comply with the latest edition of SMACNA “HVAC Duct Construction Standards – Metal and Flexible.”

E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

F. Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

1.6 QUALITY ASSURANCE

A. Welding Standards: Qualify welding procedures and welding personnel to perform welding processes for this Project according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports;

AWS D1.2, "Structural Welding Code--Aluminum," for aluminum supporting members; and AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," unless otherwise indicated.

C. Comply with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems," unless otherwise indicated.

D. Comply with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations," Chapter 3, "Duct System," for range hood ducts, unless otherwise indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver sealant and firestopping materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle sealant and firestopping materials according to manufacturer's written recommendations.

C. Deliver and store stainless-steel sheets with mill-applied adhesive protective paper maintained through fabrication and installation

D. Deliver and store all ductwork with protective material until installation. Any material left exposed to moisture and/or particulates shall be removed and replaced.

E. Any installed ductwork or piping system left temporarily incomplete shall be covered with protective material until final connections can be installed.

F. All ductwork and/or liner insulation to be wrapped with protective material until installation. Any ductwork or insulation left exposed to the environment or contaminating particulate matter shall be replaced at the contractor’s expense.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

B. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets; commercial quality; with oiled, exposed matte finish.

C. Stainless Steel: ASTM A 480/A 480M, Type 316, sheet form with No. 4 finish for surfaces of ducts exposed to view; and Type 304, sheet form with No. 1 finish for concealed ducts.

D. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

E. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for 36-inch (900-mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.2 SEALANT MATERIALS

A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

1. Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant, formulated with a minimum of 75 percent solids.
2. Flanged Joint Mastics: One-part, acid-curing, silicone, elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

2.3 HANGERS AND SUPPORTS

A. Hanger Materials: Galvanized, sheet steel or round, threaded steel rod.
   1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rod or galvanized rods with threads painted after installation.
   2. Straps and Rod Sizes: Comply with latest edition of SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for sheet steel width and thickness and for steel rod diameters.

B. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

C. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
   1. Supports for Galvanized-Steel Ducts: Galvanized steel shapes and plates.
   2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
   3. Supports for Aluminum Ducts: Aluminum support materials, unless materials are electrolytically separated from ductwork.

2.4 RECTANGULAR DUCT FABRICATION

A. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to the latest edition of SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
   1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
   2. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.

B. Fabricate range hood exhaust ducts with 0.0598-inch-thick, galvanized sheet for concealed ducts and 0.0500-inch-thick stainless steel for exposed ducts. Weld and flange seams and joints. Comply with NFPA 96.

C. Fabricate dishwasher hood exhaust ducts with 0.0500-inch-thick stainless steel. Weld and flange seams and joints.

D. Static-Pressure Classifications: Unless otherwise indicated, construct ducts to the following:
   1. Supply Ducts between AHU and Air Terminal Units: 3-inch wg.
   2. Supply Ducts after air terminal units and on constant volume supply equipment: 1-inch wg (250 Pa), positive pressure
   3. Return Ducts: 1-inch wg ,negative pressure.
   4. Exhaust Ducts: 1-inch wgnegative pressure.

E. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inchesand larger and 0.0359 inchthick or less, with more than 10 sq. ft.of unbraced panel area, unless ducts are lined.

2.5 ROUND FABRICATION

A. Round Ducts: Fabricate spiral seam supply and return ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Snap Lock Longitudinal seam ductwork will not be allowed. Adjustable elbows will not be allowed.

B. Spiral seam round or oval duct may be substituted for rectangular duct at the contractors option. Spiral seam ductwork sizing must result in the same or less pressure drop than the rectangular duct indicated on the plans.

2.6 DUCT STORGE

A. All duct must have end capped with plastic covers on both ends from end of fabrication to duct installation. If this is not provided at the field, vacuum ducts before final acceptance to remove dust and debris.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION, GENERAL

A. Duct installation requirements are specified in other DivisionSections. Drawings indicate general arrangement of ducts, fittings, and accessories.
B. Construct and install each duct system for the specific duct pressure classification indicated.
C. Install round ducts in lengths not less than 10 feet (3 m), unless interrupted by fittings.
D. Install ducts with fewest possible joints.
E. Install fabricated fittings for changes in directions, changes in size and shape, and connections.
F. Install couplings tight to duct wall surface with a minimum of projections into duct.
G. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.
H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
I. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.
J. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.
K. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
L. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches (38 mm).
N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire damper, sleeve, and firestopping sealant. Fire and smoke dampers are specified in DivisionSection "Duct Accessories." Firestopping materials and installation methods are specified in other Divisions

3.2 SEAM AND JOINT SEALING

A. General: Seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." All duct to be sealed to SMACNA seal class A which requires sealing all transverse joints, longitudinal seams and duct wall penetrations regardless of pressure classification.
B. Seal externally insulated ducts before insulation installation.
C. All ducts shall be inspected after sealing is complete and prior to insulation installation. Provide the engineer with a minimum 7 days notice prior to beginning duct insulation.

3.3 RANGE HOOD EXHAUST DUCT INSTALLATIONS

A. Install ducts to allow for thermal expansion of ductwork through 2000 deg Ftemperature range.
B. Install ducts without dips or traps that may collect residues, unless traps have continuous or automatic residue removal.

C. Install access openings at each change in direction and at 15-foot intervals; locate on sides of duct a minimum of 1-1/2 inches from bottom; and fit with grease-tight covers of same material as duct.
D. Do not penetrate fire-rated assemblies.

3.4 DISHWASHER EXHAUST DUCT INSTALLATIONS

A. Install dishwasher exhaust ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

3.5 HANGING AND SUPPORTING

A. Install rigid round and rectangular metal duct with support systems indicated in the latest edition of SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
B. Support horizontal ducts within 24 inchesof each elbow and within 48 inchesof each branch intersection.
C. Support vertical ducts at a maximum interval of 16 feetand at each floor.
D. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

3.6 CONNECTIONS

A. Connect equipment with flexible connectors according to Section "Duct Accessories."
B. For branch, outlet and inlet, and terminal unit connections, comply with the latest edition of SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

3.7 DUCT APPLICATION

A. Service: Round and rectangular, supply/return/outside -air ducts, concealed.
B. Sheet-metal with wrap insulation
C. Service: Round and rectangular, supply/return/outside -air ducts, exposed and in mechanical rooms.
   1. Sheet-metal double wall with lined insulation in-between.
   2. Inner sheet-metal duct shall be perforated in areas with acoustical requirements, ref. plans.

3.8 FIELD QUALITY CONTROL

A. Disassemble, reassemble, and seal segments of systems as required to accommodate leakage testing and as required for compliance with test requirements.
B. 25% of the duct installed after the air handling units and (prior to the air terminal units, when applicable) shall be tested in the presence of the Architect, at static pressures equal to maximum design pressure of system or section being tested. The sections of duct to be tested shall be chosen by the architect or engineer after installation of the duct. If pressure classifications are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
C. Leakage Test: Perform tests according to SMACNA's "HVAC Air Duct Leakage Test Manual."
D. Maximum Allowable Leakage: Comply with requirements for Leakage Classification 3 for round, Leakage Classification 12 for rectangular ducts in pressure classifications less than and equal to 2-inch wg (both positive and negative pressures), and Leakage Classification 6 for pressure classifications from 2- to 10-inch wg.
E. Remake leaking joints and retest until leakage is less than maximum allowable.

3.9 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect the system.

END OF SECTION

SECTION 23 33 00

HVAC DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Backdraft dampers.
   2. Manual-volume dampers.
   3. Fire dampers.
   4. Turning vanes.
   5. Duct-mounted access doors and panels.
   6. Flexible ducts.
   7. Flexible connectors.
   8. Duct accessory hardware.

1.2 SUBMITTALS

A. Product Data: For the following:
   1. Backdraft dampers.
   2. Manual-volume dampers.
   3. Fire dampers.
   4. Duct-mounted access doors and panels.
   5. Flexible ducts.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, location, and size of each field connection. Detail the following:
   1. Special fittings and manual- and automatic-volume-damper installations.
   2. Fire-damper installations, including sleeves and duct-mounted access doors and panels.

C. Product Certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

1.3 QUALITY ASSURANCE

A. NFPA Compliance: Comply with the following NFPA standards:
   1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
   2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
   1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.

B. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets, commercial quality, with oiled, exposed matte finish.

C. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
D. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for 36-inch (900-mm) length or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.2 BACKDRAFT DAMPERS

A. Description: Suitable for horizontal or vertical installations.
B. Frame: 0.052-inch- (1.3-mm-) thick, galvanized, sheet steel, with welded corners and mounting flange.
C. Blades: 0.025-inch- (0.6-mm-) thick, roll-formed aluminum.
D. Blade Seals: Vinyl.
E. Blade Axles: Galvanized steel.
F. Tie Bars and Brackets: Galvanized steel.
G. Return Spring: Adjustable tension.

2.3 MANUAL-VOLUME DAMPERS

A. General: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
B. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
   1. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of 0.064 inch (1.62 mm) thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
   2. Roll-Formed Steel Blades: 0.064-inch- (1.62-mm-) thick, galvanized, sheet steel.
   3. Blade Axles: Galvanized steel.
   4. Tie Bars and Brackets: Galvanized steel.
C. Jackshaft: 1-inch- (25-mm-) diameter, galvanized steel pipe rotating within a pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
   1. Length and Number of Mountings: Appropriate to connect linkage of each damper of a multiple-damper assembly.
D. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.4 FIRE DAMPERS

A. General: Labeled to UL 555.
B. Fire Rating: One and one-half hours.
C. Fire Rating: One and one-half hours.
D. Frame: SMACNA Type B with blades out of airstream; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.
E. Mounting Sleeve: Factory- or field-installed galvanized, sheet steel.
   1. Minimum Thickness: 0.052 inch (1.3 mm) or 0.138 inch (3.5 mm) thick as indicated, and length to suit application.
   2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.

F. Mounting Orientation: Vertical or horizontal as indicated.
G. Blades: Roll-formed, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized, sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized steel blade connectors.
H. Horizontal Dampers: Include a blade lock and stainless-steel negator closure spring.
I. Fusible Link: Replaceable, 165 deg F (74 deg C) rated as indicated.

2.5 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
B. Acoustic Turning Vanes: Fabricate of airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.6 DUCT-MOUNTED ACCESS DOORS AND PANELS

A. General: Fabricate doors and panels airtight and suitable for duct pressure class.
B. Frame: Galvanized, sheet steel, with bend-over tabs and foam gaskets.
C. Door: Double-wall, galvanized, sheet metal construction with insulation fill and thickness, and number of hinges and locks as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.
E. Insulation: 1-inch- (25-mm-) thick, fibrous-glass or polystyrene-foam board.

2.7 FLEXIBLE CONNECTORS

A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
B. Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches (89 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized, sheet steel or 0.032-inch (0.8-mm) aluminum sheets. Select metal compatible with connected ducts.
C. Extra-Wide Metal-Edged Connectors: Factory fabricated with a strip of fabric 5-3/4 inches (146 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized, sheet steel or 0.032-inch (0.8-mm) aluminum sheets. Select metal compatible with connected ducts.
D. Transverse Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches (89 mm) wide attached to two strips of 4-3/8-inch- (111-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized, sheet steel or 0.032-inch (0.8-mm) aluminum sheets. Select metal compatible with connected ducts.
E. Conventional, Indoor System Flexible Connector Fabric: Glass fabric double coated with polychloroprene.
    1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
    2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp, and 360 lbf/inch (63 N/mm) in the filling.
F. Conventional, Outdoor System Flexible Connector Fabric: Glass fabric double coated with a synthetic-rubber, weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.
    1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
    2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp, and 440 lbf/inch (77 N/mm) in the filling.

2.8 FLEXIBLE DUCTS

A. General: Comply with UL 181, Class 1.
B. Flexible Ducts, Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2-inch- (38-mm-) thick, glass-fiber insulation around a continuous inner liner.
    1. Reinforcement: Steel-wire helix encapsulated in inner liner.
    2. Outer Jacket: Polyethylene film.
    3. Inner Liner: Polyethylene film.

C. Pressure Rating: 6-inch wg (1500 Pa) positive, 1/2-inch wg (125 Pa) negative.

2.9 ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments, and length to suit duct insulation thickness.

B. Splitter Damper Accessories: Zinc-plated damper blade bracket; 1/4-inch (6-mm), zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.

C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches (75 to 450 mm) to suit duct size.

D. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and NAIMA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.

B. Install volume dampers in lined duct; avoid damage to and erosion of duct liner.

C. Provide test holes at fan inlet and outlet and elsewhere as indicated.

D. Install fire and smoke dampers according to manufacturer's UL-approved written instructions.

1. Install fusible links in fire dampers.

E. Install duct access panels for access to both sides of duct coils. Install duct access panels downstream from volume dampers, fire dampers, turning vanes, and equipment.

1. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.
2. Install access panels on side of duct where adequate clearance is available.

F. Label access doors according to Division "Mechanical Identification."

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire dampers for proper action.

C. Final positioning of manual-volume dampers is specified in Section "Testing, Adjusting, and Balancing."

END OF SECTION

SECTION 23 33 46

FLEXIBLE DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:

1. Furnish and install supply air branch duct runouts to diffusers as described in Contract Documents.

1.2 REFERENCES

A. Reference Standards:

1. National Fire Protection Association / American National Standards Institute:
   a. NFPA 90A: 'Standard for the Installation of Air-Conditioning and Ventilating Systems' (2012 Edition).
2. Underwriters Laboratories:
   a. UL 181, 'Factory-Made Ducts and Air Connectors' (10th Edition).
   b. UL 181B, 'Closure Systems for Use With Flexible Air Ducts and Air Connectors' (3rd Edition).

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:

1. Manufacturer Contact List:
   a. Anco Products Inc,
   b. Thermaflex by Flexible Technologies
   c. Flexmaster USA Inc, Houston, TX

B. Materials:

1. Ducts:
   a. Formable, flexible, circular duct which shall retain its cross-section, shape, rigidity, and shall not restrict airflow after bending.
   b. Insulation:
      1) Nominal 1-1/2 inches (38 mm), 3/4 lb per cu ft (12 kg per cu m) density fiberglass insulation with air-tight, polyethylene or polyester core, sheathed in seamless vapor barrier jacket factory installed over flexible assembly.
   c. Assembly, including insulation and vapor barrier, shall meet Class I requirement of NFPA 90A and be UL 181 rated, with flame spread of 25 or less and smoke developed rating of 50 or under.
   d. Category Four Approved Products. See Section 01 6200 for definitions of Categories:
      1) ANCO-FLEX 4625 by Anco Products.
      2) M-KC by Thermaflex by Flexible Technologies.
      3) Type 4m Insulated by Flexmaster.
2. Cinch Bands: Nylon, 3/8 inch removable and reusable type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct in fully extended condition free of sags and kinks, using 60 inch maximum lengths.

B. Make duct connections by coating exterior of duct collar for 3 inches with duct sealer and securing duct in place over sheet metal collar with specified cinch bands.

END OF SECTION

SECTION 23 34 16

CENTRIFUGAL HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes centrifugal fans and vent sets.

1.2 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base air ratings on actual site elevations.

B. Operating Limits: Classify according to AMCA standards.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each unit scheduled and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material gages and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance Data: For centrifugal fans to include in maintenance manuals specified in specifications.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.6 COORDINATION

A. Coordinate size and location of structural support members and/or shaft locations.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in these documents.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set for each belt-driven unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cook, Loren Company.
   2. Greenheck.

2.2 HOUSINGS

A. Roof Mounted Centrifugal Exhaust Fan.
   1. The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have continuously welded curb cap corners for maximum leak protection. The discharge baffle shall have a rolled bead for added strength. An integral conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring connections. Bearings and drives shall be mounted on a minimum 14 gauge steel power assembly, isolated from the unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Unit shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit tested packaging.

2.3 WHEELS

A. Roof Mounted Centrifugal Exhaust Fan
   1. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-96, Balance Quality and Vibration Levels for Fans.

2.4 SHAFTS

A. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
B. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
C. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

2.5 BEARINGS

A. Prelubricated and Sealed Shaft Bearings: Self-aligning, pillow-block-type ball bearings.
   1. Ball-Bearing Rating Life: ABMA 9, L_{50} of 200,000 hours.
   2. Roller-Bearing Rating Life: ABMA 11, L_{50} of 200,000 hours.

2.6 BELT DRIVES

A. Description: Factory mounted, with final alignment and belt adjustment made after installation.
   1. Service Factor Based on Fan Motor: 1.5.
B. Fan Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
C. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with motors larger than 5 hp. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
D. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
E. Motor Mount: Adjustable for belt tensioning.

2.7 ACCESSORIES

A. Scroll Access Doors: Shaped to conform to scroll, with quick-opening latches and gaskets.
B. Companion Flanges: Galvanized steel, for duct connections.
C. Scroll Drain Connection: NPS 1 (DN 25) steel pipe coupling welded to low point of fan scroll.
D. Shaft Cooler: Metal disk between bearings and fan wheel, designed to dissipate heat from shaft.
E. Spark-Resistant Construction: AMCA 99 (where required).
F. Shaft Seals: Airtight seals installed around shaft on drive side of single-width fans.
G. Weather Cover: Enameled-steel sheet with ventilation slots, bolted to housing.

2.8 MOTORS

A. Refer to Section "Motors" for general requirements for factory-installed motors.
B. Motor Construction: NEMA MG 1, general purpose, continuous duty, high efficiency, Design B.
C. Enclosure Type: [Open drip-proof] [Totally enclosed, fan cooled].

2.9 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install centrifugal fans level and plumb.
B. Install units with clearances for service and maintenance.
C. Label fans according to requirements specified in Section "Mechanical Identification."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Duct Accessories."
B. Install ducts adjacent to fans to allow service and maintenance.
C. Ground equipment.
D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Equipment Startup Checks:
1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Verify lubrication for bearings and other moving parts.

B. Starting Procedures:

1. Energize motor and adjust fan to indicated rpm.
2. Measure and record motor voltage and amperage.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
E. Shut unit down and reconnect automatic temperature-control operators.
F. Refer to Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.
G. Replace fan and motor pulleys as required to achieve design airflow.
H. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.
B. Adjust belt tension.
C. Lubricate bearings.

3.5 CLEANING

A. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.
B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.
1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
2. Review data in maintenance manuals. Refer to specifications Section "Closeout Procedures."
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION

SECTION 23 37 13

DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

1.2 DEFINITIONS

A. Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.

B. Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.

C. Register: A combination grille and damper assembly over an air opening.

1.3 SUBMITTALS

A. Product Data: For each model indicated, include the following:

1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
3. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
4. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.

B. Coordination Drawings: Reflected ceiling plans and wall elevations drawn to scale to show locations and coordination of diffusers, registers, and grilles with other items installed in ceilings and walls.

1.4 QUALITY ASSURANCE

A. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Diffusers, registers, and grilles are scheduled on Drawings.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Titus.
2. Price

2.2 SOURCE QUALITY CONTROL

A. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. Coordinate device locations with ceiling grid, sprinklers, and lights. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 CLEANING

A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION

SECTION 23 73 12

DX AIR HANDLING UNITS, SINGLE ZONE VAV

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Packaged air handling units.
B. Refrigeration components

1.02 RELATED SECTIONS

A. Section - Motors
B. Section - Vibration Isolation.
C. Section - Ductwork Insulation.
D. Section - Ductwork.
E. Section - Ductwork Accessories: Flexible duct connections.
F. Section - Controls and Instrumentation
G. Section - Equipment wiring systems.

1.03 REFERENCES

A. ASHRAE 90.1 ENERGY STANDARD FOR BUILDINGS EXCEPT LOW RISE RESIDENTIAL BUILDINGS
B. ANSI/AHRI 340/360 - PERFORMANCE RATING OF COMMERCIAL IND INDUSTRIAL UNITARY AIR CONDITIONING AND HEAT PUMP EQUIPMENT AND CONDENSING UNITS GREATER THAN 65,000BTUh AND BELOW 250,000BTUh
C. AHRI 340 - Commercial and Industrial Unitary Heat-pump Equipment, (heat pumps above 135,000 Btuh).

1.04 QUALITY ASSURANCE

A. Air Handling Units: Product of manufacturer regularly engaged in production of components who issues complete catalog data on total product.

1.05 SUBMITTALS

A. Submit unit performance data including: capacity, nominal and operating performance.
B. Submit Mechanical Specifications for unit and accessories describing construction, components and options.
C. Submit shop drawings indicating overall dimensions as well as installation, operation and service clearances. Indicate lift points and recommendations and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.
D. Submit data on electrical requirements and connection points. Include recommended wire and fuse sizes or MCA, sequence of operation, safety and start-up instructions.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.
B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.08 WARRANTY

A. Provide one year parts warranty.

PART 2 **PRODUCTS**

2.01 **SUMMARY**

A. The contractor shall furnish and install air handling units(s) as shown as scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

B. APPROVED MANUFACTURERS

1. Trane:
2. Carrier:
3. Lennox:
4. Substitutions: [prior approval required] as indicated under the general and/or supplemental conditions of these specifications.

2.02 **GENERAL**

A. Provide indoor-mounted, draw-thru, packaged air handling unit(s). Unit(s) shall be factory-assembled including direct-expansion evaporator coil, expansion valve(s), check valves, condensate drain pan, centrifugal fan assembly with fan motor(s) and mounting bracket sheaves, drives and belts, filters, and electrical controls. Units shall be suitable for either horizontal or vertical airflow configuration and be used with or without ductwork.

2.03 **CASING**

A. Unit casing shall be constructed of zinc-coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned and finished with a baked enamel finish.

B. Unit casing shall be completely insulated with fire-retardant, permanent, foil-faced, odorless glass fiber material.

2.04 **FANS**

A. Provide fan section with forward curved, double width, double inlet, centrifugal type fan.

B. Provide self-aligning, grease lubricated, ball or roller bearings with permanent lubrication fittings.

C. Factory mount motor on slide rails. Provide access to motor, drive, and bearings through removable casing panels.

D. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

E. Provide cast iron or steel variable and adjustable pitched sheaves, dynamically balanced, bored to fit shafts and keyed.

2.05 **COILS**

A. Provide configured aluminum fin surface mechanically bonded to copper tubing coil. Enclose coils with headers and return bends fully contained within casing. Coil shall have factory installed expansion valves and factory pressure and leak tested at 375 psig.

B. Provide double sloped condensate drain pan constructed of PVC with external connections on either side of unit. The drain pan shall be removable for cleaning.

2.06 **MOTORS**

A. For additional static requirements, Odyssey Split Systems offer standard belt drive motors to meet and exceed a wide range of airflow needs.

2.07 **FILTERS**

A. Provide one inch throwaway filters, factory installed. Provide access from side panel for removal. Filter rack shall be field convertible to two inch capability with field provided two inch

throwaway filters.

2.08 **CONTROLS**

A. Provide factory installed and wired controls including fan contactor, low voltage terminal strip and single point power entry.
B. Provide factory installed FROSTAT to prevent coil freezing at low evaporator temperatures.

PART 3 **EXECUTION**

3.01 **INSTALLATION**

A. Install in accordance with manufacturer's instructions.
B. Install unit on vibration isolators.

END OF SECTION

SECTION 26 00 00

ELECTRICAL

PART 1 – GENERAL

1.1RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Specification Sections and other Sections, apply to this Section.

1.2WORK COVERED BY CONTRACT DOCUMENTS

A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, as is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.
B. General Scope of Work:
1. Providing new panels, feeders, conduits,disconnect, fire alarm, rough-in for telephone and data system, and new light fixtures.

1.4COORDINATION

A. All electrical work shall be done under sub-contract to a General Contractor. Electrical Contractor shall coordinate all work through General Contractor, even in areas where only electrical work is to take place.

B. Work shall take place with minimal disruption to Owner’s operations in areas surrounding the new building.

C. Cooperate fully with other contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

D. Fully coordinate with mechanical contractor for providing power to mechanical equipment.

1.5UTILITIES

1. Coordinate with power company and provide conduit, and trenching from transformer to power source. Coordinate with water, telephone, cable and gas utilities to locate all utilities prior to digging in any area.
2. Obtain any approvals required from utilities to relocate utilities.
3. Cost of relocating or bypassing utilities indicated on drawings shall be included in Base Bid.

1.6CONTRACTOR USE OF PREMISES

A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

1. Driveways and Entrances: Keep driveways and entrances serving the premises, clear and available to the Owner, the Owner's employees, and emergency vehicles at all time. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:

1. Temporary fencing around construction areas.
2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be

covered at night and warning lights provided on construction barricades.

3. Temporary fencing around equipment while site work is in progress.

1.7 SUBMITTALS

1. To extradite the submittal process more efficiently, do not piece-meal the submittals. Submit entire electrical in a bound enclosure. This will eliminate delays in the submittal process. Unbound submittals shall be returned without review. Submit 10 copies minimum.

END OF SECTION

SECTION 26 00 01
ELECTRICAL GENERAL REQUIREMENTS

PART1-GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions, Specification Sections and all relevant documents shall form a part of this Section of the Specifications, and shall be incorporated in this Section and each Section 260000 hereinafter as if repeated verbatim herein. All conditions imposed by these documents shall be applicable to all portions of the work under this Section. Certain specific paragraphs of said references may be referred to hereinafter in this Section. These references are intended to point out specific items to the Contractor, but in no way relieve him of the responsibility of reading and complying with all relevant parts of the entire Specification.

B. The Contractor shall examine and coordinate with all Contract Drawings and Specifications, and all Addenda issued. Failure to comply shall not relieve him of responsibility. The omission of details of other portions of the work from this Section shall not be used as a basis for a request for additional compensation.

C. The specific features and details for other portions of the work related to the construction in progress or to the adjacent building shall be determined by examination at the site.

1.2 SCOPE OF WORK

A. The requirements contained in this Section apply to all work performed under these Specifications.

B. The work covered by this Section of the Specifications comprises the furnishing of labor, material, equipment, transportation, tools and services, and performing operations required for, and reasonably incidental to, the installation of the work in accordance with the applicable Contract Documents, and subject to the terms and conditions of the Contract.

C. Refer to other Sections of the Specifications for related work.

1.3 DEFINITION OF "CONTRACTOR"

A. Where the word "Contractor" is used under any Section of this Section of the Specifications, it shall mean the Contractor engaged to execute the work included under that Section, even though this Contractor may be technically described as a Subcontractor, or an authorized representative.

B. If the Contractor, engaged to execute a portion of the work, employs a Subcontractor to perform some of that work, he shall be completely responsible for the proper execution of this Subcontractor’s work, in full conformity with the Contract Documents.

1.4 RESPONSIBILITY OF THE CONTRACTOR

A. The Contractor shall be responsible for all work of every description in connection with this Section of the Specifications. The Contractor shall specifically and distinctly assume, and does zeso assume, all risk for damage or injury from whatever cause to property or person used or employed on or in connection with this work and of all damages or injury to any person or property wherever located, resulting from an action or operation under the Contract in connection with the work, and undertake the responsibility to defend the Owner against all claims on account of any such damage or injury.

B. The Contractor will be held responsible for the satisfactory execution and completion of the work in accordance with the true intent of the Contract Documents. The Contractor shall provide without extra charge all incidental items required as part of the work, even though it may not be specifically indicated. If the Contractor has reason for objecting to the use of any material, equipment, device or method of construction as indicated, the Contractor shall make report of such objections to the Owner's Representative, obtain proper approval and adjustment to the Contract, and shall proceed with the work.

1.5 TERMINOLOGY

A. Whenever the words "furnish", "provide", "furnish and install", "provide and install", and similar phrases occur, it is the intent that the materials, equipment and devices described be furnished, installed and connected under this Section, complete for operation, unless specifically noted to the contrary.

B. It is also the intent, unless specifically noted to the contrary, that all materials, equipment and devices described and specified under this Section of the Specifications be similarly furnished, installed and connected under this Section, whether or not a phrase as described in the preceding paragraph has been actually included.

C. Whenever the words “Owner’s Representative” occurs, it is intended to refer to the Architect, Engineer and/or specific Owner’s Representative responsible for or capable of providing the necessary direction pertaining to the referenced issue.

1.6 ORDINANCES, PERMITS AND CODES

A. It shall be the Contractor's duty to perform the work and provide the materials covered by these specifications in conformance with all ordinances and regulations of all authorities having jurisdiction.

B. All work herein shall conform to all applicable laws, ordinances and regulations of the local utility companies.

C. The Contractor shall obtain and pay for all permit and connection fees as required for the complete installation of the specified systems, equipment, devices and materials.

D. The Contractor shall obtain permits, plan checks, inspections and approvals applicable to the work as required by the regulatory authorities. Fees and costs of any nature whatsoever incidental to these permits, inspections and approvals shall be assumed and paid by the Contractor. The pro-rata costs, if any, for utilities serving this property will be paid for by the Owner and shall not be included as part of this Contract.

E. The work shall be in accordance with, but shall not be limited to, the requirements of:

1 National Fire Protection Association

2 National Electrical Code

3 National Safety Code

4 State of Texas Safety Code

5 Local City Building Codes

6 State of Texas Building Codes

F. Codes and standards referred to are minimum standards. Where the requirements of the Drawings or Specifications exceed those of the codes and regulations, the Drawings and Specifications govern.

1.7 MATERIALS, EQUIPMENT AND DEVICE DESCRIPTION

A. Materials, equipment and devices shall be of the best quality customarily applied in quality commercial practice, and shall be the products of reputable manufacturers. Each major component shall bear a nameplate giving the name and address of the manufacturer, and the catalog number or designation of the component.

B. Materials, equipment and devices furnished under this Section of the Specifications shall be essentially the standard product of the specified manufacturer, or where allowed, an alternate manufacturer. Where two or more units of the same kind or class of a specific item are required, these shall be the products of a single manufacturer; however, the component parts of the item need not be the products of one manufacturer.

C. In describing the various materials, equipment and devices, in general each item will be described singularly, even though there may be a multiplicity of identical items. Also, where the description is only

general in nature, exact sizes, duties, space arrangements, horsepower requirements and other data shall be determined by reference to the Contract Documents.

D. Space allocations for materials, equipment and devices have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer whether indicated or not. The Contractor shall verify that all materials, equipment and devices proposed for use on this project are within the constraints of the allocated space.

1.8 QUALITY ASSURANCE

A. Materials, equipment and devices shall be new and of the quality specified, and shall be free from defects at the time of installation. Materials, equipment and devices damaged in shipment or otherwise damaged or found defective prior to acceptance by the Owner shall not be repaired at the job site, but shall be replaced with new materials, equipment or devices identical with those damaged, unless specifically approved otherwise by the Owner's Representative.

B. Wherever a UL standard has been established for a particular type of material, equipment or device, each item of such material, equipment or device provided on this project shall meet the requirements of the UL standard in every way, and shall be UL listed and labeled.

1.9 REFERENCE STANDARDS

A. Materials, equipment, devices and workmanship shall comply with applicable local, county, state and national codes, laws and ordinances, utility company regulations and industry standards.

B. In case of differences between building codes, state laws, local ordinances, industry standards, utility company regulations and the Contract Documents, the most stringent shall govern. The Contractor shall promptly notify the Owner's Representative in writing of any such difference. Should the Contractor perform any work that does not comply with local codes, laws and ordinances, industry standards or other governing regulations, the work shall be corrected of noncompliance deficiencies with the Contractor bearing all costs.

C. In addition to the aforementioned ordinances, industry standards published by the following organizations shall apply:

AABM	-	American Association of Battery Manufacturers
ADA	-	American’s with Disabilities Act
AIA	-	American Institute of Architects
ANSI	-	American National Standards Institute
ASTM	-	American Society for Testing and Materials
CBM	-	Certified Ballast Manufacturers Association
ETL	-	Electrical Testing Laboratories
FM	-	Factory Mutual
ICEA	-	Insulated Cable Engineers Associated
IEEE	-	Institute of Electrical and Electronic Engineers
IES	-	Illuminating Engineering Society
IRI	-	Industrial Risk Insurance
NBS	-	National Bureau of Standards
NEC	-	National Electrical Code
NECA	-	National Electrical Contractors Association
NEMA	-	National Electrical Manufacturers Association

NESC	-	National Electrical Safety Code
NETA	-	National Electrical Testing Association
NFPA	-	National Fire Protection Association
UL	-	Underwriters Laboratories

1.10 DRAWINGS AND SPECIFICATIONS

A. The interrelation of the Drawings (including the schedules) and the Specifications are as follows:

1 The Drawings establish quantities, locations, dimensions and details of materials, equipment and devices. The schedules on the Drawings indicate the capacities, characteristics and components.

2 The Specifications provide written requirements for the quality, standard and nature of the materials, equipment, devices and construction systems.

B. The Drawings and Specifications shall be considered as being compatible; therefore, the work called for by one and not by the other shall be furnished and installed as though called for by both. Resolution of conflicts between Drawings and Specifications shall be as follows:

1 If the Drawings and Specifications disagree in themselves, or with each other, the Contractor's pricing shall be based on furnishing and installing the most expensive combination of quality and quantity of work indicated for a complete operable system. Contractor is responsible to notifying the Architect and Engineer. In the event of this type of disagreement, the resolution shall be determined by the Owner's Representative. The contractor shall assume for an operable system at the most expensive combination as per the latest National Electrical Code. The contractor shall review all drawings and specifications prior to bid date.

2 The Contractor shall be responsible for bringing any conflicts in the Drawings and the Specifications to the attention of the Owner's Representative immediately, prior to bid date.

3 In general, if there is conflict between the Drawings and Specifications, the Drawings shall govern the Specifications.

4 Where the Specifications do not fully agree with schedules on the Drawings, the schedules shall govern. Actual numerical dimensions indicated on the Drawings govern scale measurements and large scale details govern small scale drawings.

5 Materials, equipment and devices called for on the Drawings and not indicated herein, shall be completely provided and installed as though it were fully described herein.

6 Materials, equipment and devices called for herein shall be completely provided and installed, whether or not it is fully detailed, scheduled or indicated on the Drawings.

C. The Contractor shall examine the Drawings and Specifications of the other portions of the work for fixtures and finishes in connection with this work. The Contractor shall carefully examine the Drawings to determine the general construction conditions, and shall familiarize himself with all limitations caused by such conditions.

D. When discrepancies exist between scale and dimension, or between the Drawings of the various portions of the work, they shall be called to the attention of the Owner's Representative for further instruction, whose instructions shall be final and binding and work promptly resumed without any additional cost to the Owner.

E. Review the construction details of the building(s) as illustrated on the Drawings of the other portions of the work, i.e., architectural, structural, civil, landscape, etc., and be guided thereby. Route conduits and set all boxes as required by the pace of the general construction.

F. The Drawings diagrammatically show the sizes and locations of the various equipment and devices, and the sizes of the major interconnecting wires, without showing exact details as to elevations, offsets, control

wiring and other installation requirements. Carefully layout the work at the site to conform to the architectural and structural conditions, to avoid obstructions and to permit proper grading of pipe associated with other portions of the work. In cooperation with other Contractors, determine the exact location of equipment and devices and connections thereto by reference to the submittals and rough-in drawings, and by measurements at the site. Make minor relocations necessitated by the conditions at the site, or directed by the Owner's Representative, without additional cost to the Owner.

G. The Drawings and Specifications are intended to describe and illustrate systems which will not interfere with the structure of the building(s), fit into the available spaces, and insure complete and satisfactory operating installations. Prepare installation drawings as required for all critical areas illustrating the installation of the work in this Section as related to the work of all other Sections and correct all interferences with the other portions of the work or with the building structures before the work proceeds.

H. The Drawings do not indicate the existing electrical installations other than to identify modifications or extensions thereto. Visit the site and ascertain the conditions to be met and the work to be accomplished in removing and modifying the existing work, and in installing the new work. Failure to comply with this shall not constitute grounds for any additional payment in connection with removing or modifying any part of the existing installation or installing any new or temporary work under this Section.

1.11 SUBMITTALS

A. Submit product data and shop drawings in accordance with the Specifications.

B. Process product data and shop drawings to insure that the proposed materials, equipment and devices conform to the requirements of the Contract Documents, and that there are no omissions or duplications. Provide layouts, fabrication information and data for systems, materials, equipment and devices proposed for the project.

C. Submittals shall be provided for review and approval on all systems, equipment, devices and materials proposed for use on this project. Submittals shall include, but not be limited to, the following:

1 Lighting and Appliance Panelboards

2 Disconnect Switches

3 Circuit Breakers and Fuses

4 Materials: conduit, conductors, connectors, supports, etc.

5 Lighting Fixtures, Lamps and Control Systems/Devices

6 Wiring Devices

7 Transformers

8 Distribution Panelboards

9 Motor Control Center

10 As indicated on each submittal section

D. The product data shall not consist of manufacturer's catalogs or cut sheets that contain no indication of the exact item offered. The submission on individual items shall designate the exact item offered.

E. Do not submit detailed quantitative listings of materials, equipment and devices. It is the Contractor's responsibility to provide proper sizes and quantities to conform to Contract Documents.

F. Assemble submittals on related items procured from a single manufacturer in bound brochures or other suitable package form, rather than submitting a multiplicity of loose sheets.

G. Prepare shop drawings whenever equipment proposed varies in physical size and arrangement from that indicated thus causing rearrangement of equipment space, where tight spaces require extreme coordination between this work and other work, where called for elsewhere in these Specifications and where specifically requested by the Owner's Representative. Shop drawings shall be prepared at a scale of not

less than 1/4 inch equals 1 foot.

H. The Contractor shall sign the submittal as an indication of compliance with the Contract Documents. If there are any deviations from the Contract Documents, he shall so indicate on the submittal. Any deviations not so indicated shall be cause for rejection and removal of the non-complying equipment at the Contractor's expense.

1.12 SUBSTITUTIONS

A. Where a single manufacturer is mentioned by trade name or manufacturer's name, unless specifically noted otherwise, it is the only manufacturer that will be accepted.

B. Where multiple manufacturers are listed, none other than those manufacturers will be accepted.

C. Manufacturers not listed will be considered for substitution prior to bid only. The substitute manufacturer shall submit a complete copy of the appropriate technical specification section minimum seven (7) business days prior to bid with each sub-paragraph noted with the comment, "compliance", "deviation", "alternate" or "not applicable". In the case of non-primary, vendor-supplied items, the name of the sub-vendor supplying said item, including model number, shall be indicated.

1 By noting the term "compliance" or "C", it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.

2 By noting the term "deviation" or "D", it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer shall indicate all deviations.

3 By noting the term "alternate" or "A", it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner. An alternate shall be fully described as to what the manufacturer proposes to provide.

4 By noting the term "not applicable" or "N/A", it shall be understood that the specified item is not applicable to the project.

D. It shall be understood that space allocations have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer whether indicated or not. If any item of equipment or device is offered in substitution which differs substantially in dimension or configuration from that indicated on the Drawings or specifications, provide as part of the submittal 1/4 inch equals 1 foot scaled drawings showing that the substitute can be installed in the space available without interfering with other portions of the work or with access for operations and maintenance in the completed project.

E. Where substitute equipment or devices requiring different arrangement or connections from that indicated is accepted by the Owner's Representative, install the equipment or devices to operate properly and in harmony with the intent of the Contract Documents, making all incidental changes in piping, ductwork or wiring resulting from the equipment or device selection without any additional cost to the Owner. The Contractor shall pay all additional costs incurred by other portions of the work in connection with the substituted equipment or device.

F. The Owner's Representative reserves the right to call for samples of any item of material, equipment or device offered in substitution, together with a sample of the specific item when, in their opinion, the quality of the item and/or the appearance is involved, and it is deemed that an evaluation of the item may be better made by visual inspection.

G. When any request for a substitution of material, equipment or device is submitted and rejected, the item named in the Contract Documents shall be furnished. Repetitive submittal of substitutions for the same item will not be considered.

1.13 INSTALLATION DRAWINGS

A. Prepare installation drawings for coordinating the work of this Section with the work of other Sections, to

illustrate its concealment in finished spaces, to avoid obstructions, and to demonstrate the adaptability of any item of material, equipment or device in the space upon which the Contract Documents are based.

B. Use these drawings in the field for the actual installation of this work. Provide three (3) copies, not for approval, to the Owner's Representative for his information, review and record.

1.14 WORKMANSHIP AND INSTALLATION

A. In no case shall the Contractor provide a class of material, equipment, device or workmanship less than that required by the Contract Documents or applicable codes, regulations, ordinances or standards. All modifications which may be required by a local authority having legal jurisdiction over all or any part of the work shall be made by the Contractor without any additional charge. In all cases where such authority requires deviations from the requirements of the Drawings or Specifications, the Contractor shall report same to the Owner's Representative and shall secure his approval before the work is started.

B. The work shall be performed by properly licensed technicians skilled in their respective trades. All materials, equipment and devices shall be installed in accordance with the recommendations of the manufacturer and in the best standard practice to bring about results of a first class condition.

C. The NECA "Standards of Installation" as published by the National Electrical Contractors Association shall be considered a part of these Specifications, except as specifically modified by other provisions contained in these Specifications.

1.15 INSPECTION OF SITE

A. The accompanying drawings do not indicate existing installations other than to identify modifications of and extensions thereto. The Contractor shall visit the site, inspect the installations and ascertain the conditions to be met and the work to be performed. Failure to comply with this shall not constitute ground for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work under this Section.

B. Review construction details of the adjacent building presently under construction during the site inspection and include all work required to modify the existing installations and install new materials, comprising a part of the installation. Review all construction details of the new building as illustrated on the drawings and be guided thereby.

1.16 WARRANTY

A. All materials, equipment, devices and workmanship shall be warranted for a period of one year from the date of acceptance by the Owner's Representative for beneficial use by the Owner, except that where specific equipment is noted to have extended warranties. The warranty shall be in accordance with AIA Document A201. The Contractor shall be responsible for the proper registration of these warranties so that the Owner can make all proper claims should future need develop.

B. The Contractor shall furnish to the Owner's Representative for transmittal to the Owner, the name, address and telephone number of those persons responsible for service on systems and equipment covered by the warranty.

1.17 OPERATION PRIOR TO ACCEPTANCE

A. When any equipment is operable, and it is to the advantage of the Contractor to operate the equipment, the Contractor may do so provided that he properly supervises the operation, and retains full responsibility for the equipment operated. Regardless of whether or not the equipment has or has not been operated, the Contractor shall clean the equipment properly, make required adjustments and complete punch list items before final acceptance by the Owner.

1.18 INSTRUCTION OF OWNER'S PERSONNEL

A. Provide the services of competent engineers and/or technicians acceptable to the Owner's Representative to instruct other representatives of the Owner in the complete and detailed operation of each item of

equipment or device of all the various electrical systems. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results. Upon completion of these instructions, the Contractor shall obtain a letter of release, acknowledged by the Owner or his authorized representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.

B. The Contractor shall be fully responsible for proper maintenance of equipment and systems until the instructions have been given to the Owner's personnel and the letter of release acknowledged.

C. In providing the instructions to the Owner's personnel, the written operating and maintenance manuals shall be followed in all instances, and the Owner's personnel shall be familiarized with such manuals. Operating and maintenance manuals used for instructions shall include wiring diagrams, manufacturer's operating and maintenance instructions, parts lists (with sources identified), and other data as appropriate for each system.

1.19 SCHEDULE AND SEQUENCE OF WORK

A. The Contractor shall meet and cooperate with the Owner and Owner's Representative to schedule and sequence this work so as to insure meeting scheduled completion dates and avoid delaying other portions of the work. Work requiring special sequencing shall be at no additional cost to the Owner and shall have no impact on the schedule.

1.20 INSTALLATION INSPECTIONS AND CERTIFICATIONS

A. Obtain timely inspections of the installation by the regulatory authorities. Remedy any deficiencies to the satisfaction of the inspecting official.

B. Upon final completion of the work, obtain certificates of acceptance from the regulatory authorities. Deliver the certificates to the Owner's Representative for transmission to the Owner.

1.21 EQUIPMENT INSTALLATION

A. Install equipment and devices in a manner to permit access to all surfaces or components, requiring such access, without the need to disassemble other unrelated parts of the work.

B. Equipment specified to be factory assembled and tested prior to shipment shall not be disassembled at the job site and reassembled at its final location. Apparatus not so specified may be disassembled and reassembled in the proper location.

C. Furnish all scaffolding, rigging and hoisting required for the installation of all the work.

1.22 CONCRETE HOUSEKEEPING PADS

A. Concrete housekeeping pads shall be provided for all floor mounted equipment, unless noted or required otherwise.

B. All pads shall be not less than 3-1/2" high and extend a maximum 3" beyond the actual equipment size. Coordinate the proper size of the pad with the equipment furnished. Pads shall be poured in forms built of new dressed lumber with corners chamfered using sheet metal or triangular wood strips nailed to the form. Use 6 x 6 No. 3 mesh for reinforcing. Install heavy duty adjustable anchor bolts, set in the form and positioned using templates, prior to pouring concrete. After the equipment is set on the pad, the equipment shall be aligned, leveled and fully grouted to the pad and all void spaces shall be filled with a non-shrinking grout.

C. Perform all concrete work specified to be provided under this Section in strict accordance with the applicable provisions of Section, CONCRETE.

1.23 SLEEVES

A. Each conduit, regardless of material, which passes through a concrete slab, masonry wall, or roof or portion of the building structure shall be free from the structure and shall pass through a sleeve.

B. All sleeves shall be constructed from electrical-metallic tubing or equivalent weight galvanized steel tubing and shall be flush on both sides of the surface penetrated, unless noted otherwise. All sleeves penetrating the roof areas shall extend a minimum 10 inches above the roof with approved weatherproof counterflashing attached to the conduit above the roof. All sleeves penetrating floors shall extend a minimum of 6 inches above the finished floors. The sleeves shall be sized to allow free passage of the conduit to be inserted.

C. Sleeves passing through walls or floors on or below grade or in moist areas shall be constructed of galvanized rigid steel and shall be designed with a suitable flange in the center to form a waterproof passage. After the conduit has been installed in the sleeves, the void space around the conduit shall be caulked and filled with an asphalt-base compound to insure a waterproof penetration. Jute twine caulking shall not be used due to susceptibility to termite infestation.

1.24 ESCUTCHEONS

A. In each finished space, provided a chromium plated, sectional escutcheon on each conduit, or hanger rod penetrating a wall, floor or ceiling.

B. Size escutcheons and collars to fit snugly around conduit and rods.

C. Where required, provide escutcheons with set screws so that they fit snugly against the finished surface.

1.25 ACCESS PANELS

A. Provide wall and ceiling access panels for unrestricted access to all concealed electrical equipment items and devices installed behind furrings, chases or non-removable suspended ceilings.

B. Access panels shall be UL listed and labeled as required to suit the fire rating of the surface in which installed, with mounting straps, concealed hinges, screwdriver locks, 180 degree open door design, 16 gauge steel construction and door and frame finished in prime coat finish. Panels shall be 12-inch by 12-inch minimum size, but shall be larger as the access requirement of the concealed electrical equipment item or device increases.

1.26 SEALING OF PENETRATIONS

A. All penetrations in horizontal or vertical fire-rated construction shall be sealed using approved fire-rated sealing materials equivalent to the following:

1 Foam: Dow Corning 3-6548 RTV silicone foam, liquid component Part 4 (black) and liquid component Part B (off-white).

2 Sealant: Dow Corning 96-081 RTV silicone adhesive sealant.

3 Damming Materials: Mineral fiberboard, mineral fiber matting, mineral fiber putty, plywood or particle board, as selected by applicator.

B. Preparation: Remove combustible materials and loose impediments from penetration opening and involved surfaces. Remove free liquid and oil from penetration surfaces.

C. Installation: In accordance with manufacturer's instructions, install damming materials and sealant to cover and seal penetration openings; inject foam mixtures into openings.

D. In addition to the Dow Corning products, equal products by Spec Seal Firestop Products, 3M Fire Barrier or CS240 Firestop are acceptable.

1.27 PROTECTION OF APPARATUS

A. At all times take every precaution to properly protect apparatus from damage due to dust, dirt, water, etc. or from damage due to physical forces. Include the erection of temporary shelters as required, to adequately protect any apparatus stored at the site, the cribbing of any apparatus directly above the construction, and the covering of apparatus in the incomplete building with tarpaulins or other protective covering. Failure on the part of the Contractor to comply with the above to the entire satisfaction of the

Owner's Representative will be sufficient cause for the rejection of the pieces of apparatus in question.

B. Responsibility for the protection of apparatus extend also to existing apparatus involved in this Section of the work, whether such apparatus is designated to be used temporarily and later removed, or is to be reused as a part of the permanent installation. Erect temporary sheltering structures, provide temporary bracing and supports, or cover equipment as required or directed to afford proper protection for that equipment.

C. The Contractor shall protect this work and the work of all other Contractors from damage by his work or workmen and shall make good any damage thus caused. He shall also be responsible for the proper protection of his equipment, machinery, materials and accessories delivered and installed on the job.

1.28 INSTALLATION OF CONTROL AND OPERATING DEVICES

A. The highest operable part of controls (light switches, dimmer switches, emergency power off devices, etc.), receptacles (electrical and communications) and other operable devices shall be 48" above finish floor. The lowest operable part shall be no less than 15" above finished floor. For purposes of uniformity, unless noted otherwise, the top of a device shall be maximum 48" AFF and the bottom of a device shall be minimum 15" AFF. Refer to the electrical symbols list on the Drawings for specific requirements.

B. Visual alarm appliances shall be placed 80" above finished floor (the highest floor level within a space) or 6" below the ceiling, whichever is lower.

1.29 INSTALLATION AND CONNECTION OF OTHER SECTION'S EQUIPMENT

A. Verify the electrical requirements of all equipment furnished under other Sections, separate contracts, or by the Owner. Install conduit, power wiring, control wiring, devices, etc. as required for complete operation of all equipment.

1.30 OPTION TO RELOCATE OUTLETS AND RELATED DEVICES

A. The location of power, data and telephone outlets, wall switches and other related devices

may be relocated at the Owner's option, at no

additional cost to the Owner, to a point within10 feet of their present location provided the Contractor is notified prior to installation.

1.31 COOPERATION AND CLEAN-UP

A. It shall be the responsibility of the Contractor to cooperate fully to keep the job site in a clean and safe condition. Upon the Contractor shall immediately remove all of his tools, equipment, surplus materials and debris.

B. After he installation is complete and before the equipment is energized, clean the interior and exterior of all equipment thouroughly. Clean equipment, removing all debris, rubbish and foreign materials. Each component shall be cleaned and all dust and other foreign material. Components shall be cleaned of oxidation. The inside and outside of all switchgear shall also be wiped clean with lemon-oil rag after all other cleaning is complete. Any portion of the work requiring touch-up finishing shall be so finished to equal the specified finish on the product.

1.32 RECORD DRAWINGS AND DOCUMENTATION FOR OWNER

A. The Contractor shall obtain at his own expense a complete set of blueline prints on which to keep an accurate record of the installation of all materials, equipment and devices covered by the Contract. The Contractor shall record up to date information at least once a week and retain the set of prints on site for periodic review by the Architect/Engineer. The record drawings shall indicate the location of all equipment and devices, and the routing of all systems. If the Contractor prepared large scale installation drawings of electrical rooms, conduit routing, busduct, routing, etc., these drawings or reproducible sepias therefrom shall be revised as required to accurately illustrate the actual installation. All conduit buried in concrete slabs, walls and below grade shall be located by dimension; both horizontally and by vertical

elevation, unless a surface mounted device in each space indicates the exact location.

B. Upon anticipated completion of the job, obtain one complete reproducible set of the original drawings on which to neatly, legibly and accurately transfer all project related notations and deliver these record drawings to the Architect/Engineer at job completion before final payment and delivery to the Owner. This information shall be delivered prior to final acceptance.

C. The Contractor shall accumulate in duplicate during the job progress, the following data prepared in indexed 3-ring looseleaf, hard-back binders sized for 8-1/2 inch by 11 inch sheets. No binder shall exceed 3-1/2 inches thick. This data shall be turned over to the Owner's Representative for review and subsequent delivery to the Owner prior to final acceptance.

1 Warranties, guarantees and manufacturer's directions on material, equipment and devices covered by the Contract.

2 Approved lighting fixture brochures, wiring diagrams and control diagrams.

3 Copies of approved submittals and shop drawings.

4 Operating instructions and recommended maintenance procedures for major apparatus.

5 Copies of all other data and/or drawings required during construction.

6 Repair parts list of major apparatus, including name, address and telephone number of local supplier or representative.

7 Tag charts and diagrams hereinbefore specified.

1.33 FINAL OBSERVATION

A. The purpose of the final observation is to determine whether the Contractor has completed the construction in accordance with the Contract Documents and that in the Owner Representative's opinion the installation is satisfactory for final acceptance by the Owner.

B. It shall be the responsibility of the Contractor to assure that the installation is ready for final acceptance prior to calling upon the Owner's Representative to make a final observation.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 2605 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Raceways.
2. Building wire and connectors.
3. Supporting devices for electrical components.
4. Electrical identification.
5. Electricity-metering components.
6. Concrete equipment bases.
7. Electrical demolition.
8. Cutting and patching for electrical construction.
9. Touchup painting.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. IMC: Intermediate metal conduit.

D. LFMC: Liquidtight flexible metal conduit.

E. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For electricity-metering equipment.

B. Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

C. Coordinate electrical service connections to components furnished by utility companies.

1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Architectural documents.

E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm)o.c., in webs.

D. Slotted-Steel Channel Supports: Comply with Division Section "Metal Fabrications" for slotted channel framing.

1. Channel Thickness: Selected to suit structural loading.

2. Fittings and Accessories: Products of the same manufacturer as channel supports.

E. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

F. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

G. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.

H. Expansion Anchors: Carbon-steel wedge or sleeve type.

I. Toggle Bolts: All-steel springhead type.

J. Powder-Driven Threaded Studs: Heat-treated steel.

2.2 ELECTRICAL IDENTIFICATION

A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Raceway and Cable Labels: Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.

1. Type: Pretensioned, wraparound plastic sleeves. Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the item it identifies.

2. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is overlaminated with a clear, weather- and chemical-resistant coating.

3. Color: Black letters on orange background.

4. Legend: Indicates voltage.

C. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick (25 mm wide by 0.08 mm thick).

D. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:

1. Not less than 6 inches wide by 4 mils thick (150 mm wide by 0.102 mm thick).

2. Compounded for permanent direct-burial service.

3. Embedded continuous metallic strip or core.

4. Printed legend that indicates type of underground line.

E. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

F. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.

G. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch (1.6-mm) minimum thickness for signs up to 20 sq. in. (129 sq. cm) and 1/8-inch (3.2-mm) minimum thickness for larger sizes. Engraved legend in black letters on white background.

H. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.

I. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm), galvanized-steel backing, with colors, legend, and size appropriate to the application. 1/4-inch (6-mm) grommets in corners for mounting.

J. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.3 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING

A. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.

B. Meter Sockets: Comply with requirements of electrical power utility company.

C. Modular Meter Centers: Factory-coordinated assembly of a main meter center circuit-breaker unit with wireways, tenant meter socket modules, and tenant branch circuit breakers arranged in adjacent vertical sections, complete with interconnecting buses.

1. Housing: NEMA 250, Type 3R enclosure.

2. Tenant Branch Circuit Breakers: Series combination rated to protect circuit breakers in downstream panelboards that have 10,000-A interrupting capacity, minimum.

2.4 CONCRETE BASES

A. Concrete Forms and Reinforcement Materials: As specified in Division Section "Cast-in-Place Concrete."

B. Concrete: 3000-psi (20.7-MPa), 28-day compressive strength as specified in Division Section "Cast-in-Place Concrete."

2.5 TOUCHUP PAINT

A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 RACEWAY AND CABLE INSTALLATION

A. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.

B. Install raceways and cables at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.

C. Use temporary raceway caps to prevent foreign matter from entering.

D. Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

E. Use raceway and cable fittings compatible with raceways and cables and suitable for use and location.

F. Install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least 1-inch (25-mm) concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.

2. Space raceways laterally to prevent voids in concrete.

3. Install conduit larger than 1-inch trade size (DN27) parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.

4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.
5. Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel raceways.

G. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.

H. Install telephone and signal system raceways, 2-inch trade size (DN53) and smaller, in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements, in addition to requirements above.

I. Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of 72-inch (1830-mm) flexible conduit. Install LFMC in wet or damp locations. Install separate ground conductor across flexible connections.

J. Set floor boxes level and trim after installation to fit flush to finished floor surface.

3.3 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.

B. Dry Locations: Steel materials.

C. Support Clamps for PVC Raceways: Click-type clamp system.

D. Selection of Supports: Comply with manufacturer's written instructions.

E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

3.4 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

F. Install 1/4-inch- (6-mm-) diameter or larger threaded steel hanger rods, unless otherwise indicated.

G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

I. Simultaneously install vertical conductor supports with conductors.

J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.

K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:

1. Wood: Fasten with wood screws or screw-type nails.
2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.

3. New Concrete: Concrete inserts with machine screws and bolts.
4. Existing Concrete: Expansion bolts.
5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
6. Steel: Welded threaded studs or spring-tension clamps on steel.
    a. Field Welding: Comply with AWS D1.1.
7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
8. Light Steel: Sheet-metal screws.
9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.5 IDENTIFICATION MATERIALS AND DEVICES

A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

C. Self-Adhesive Identification Products: Clean surfaces before applying.

D. Identify raceways and cables with color banding as follows:

1. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2 inches (51 mm) wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (8-m) maximum intervals in congested areas.
3. Colors: As follows:
    a. Fire Alarm System: Red.
    b. Security System: Blue and yellow.
    c. Telecommunication System: Green and yellow.

E. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

F. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches (150 to 200 mm) below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches (400 mm), overall, use a single line marker.

G. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

1. Phase A: Black.
2. Phase B: Red.
3. Phase C: Blue.
4. Neutral: White.
5. Ground: Green.

H. Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

1. Phase A: Brown.
2. Phase B: Orange.
3. Phase C: Yellow.
4. Neutral: White with a colored stripe or gray.
5. Ground: Green.

I. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

J. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch-(9-mm-) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

3.6 UTILITY COMPANY ELECTRICITY-METERING EQUIPMENT

A. Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

3.7 FIRESTOPPING

A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Division Section "Firestopping."

3.8 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.9 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.10 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:

1. Raceways.
2. Building wire and connectors.
3. Supporting devices for electrical components.
4. Electrical identification.
5. Electricity-metering components.
6. Concrete bases.
7. Electrical demolition.
8. Cutting and patching for electrical construction.
9. Touchup painting.

B. Test Owner's electricity-metering installation for proper operation, accuracy, and usability of output data.

1. Connect a load of known kW rating, 1.5 kW minimum, to a circuit supplied by the metered feeder.
2. Turn off circuits supplied by the metered feeder and secure them in the "off" condition.
3. Run the test load continuously for eight hours, minimum, or longer to obtain a measurable meter indication. Use a test load placement and setting that ensure continuous, safe operation.
4. Check and record meter reading at end of test period and compare with actual electricity used based on test load rating, duration of test, and sample measurements of supply voltage at the test load connection. Record test results.
5. Repair or replace malfunctioning metering equipment or correct test setup; then retest. Repeat for each meter in installation until proper operation of entire system is verified.

3.11 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint. Paint materials and application requirements are specified in Division Section "Painting."

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.12 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTOR AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

A. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.4 QUALITY ASSURANCE

A. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

B. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver wires and cables according to NEMA WC 26.

1.6 COORDINATION

A. Coordinate layout and installation of cables with other installations.

B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Wires and Cables:
      a. American Insulated Wire Corp.; Leviton Manufacturing Co.
      b. BICC Brand-Rex Company.
      c. Carol Cable Co., Inc.
      d. Senator Wire & Cable Company.
      e. Southwire Company.
   2. Connectors for Wires and Cables:
      a. AMP Incorporated.
      b. General Signal; O-Z/Gedney Unit.
      c. Monogram Co.; AFC.
      d. Square D Co.; Anderson.

e. 3M Company; Electrical Products Division.

2.2 BUILDING WIRES AND CABLES

A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Wire and Insulation Applications" Article.

B. Rubber Insulation Material: Comply with NEMA WC 3.

C. Thermoplastic Insulation Material: Comply with NEMA WC 5.

D. Ethylene Propylene Rubber Insulation Material: Comply with NEMA WC 8.

E. Conductor Material: Copper.

F. Stranding: Solid conductor for No. 10 AWG and smaller; stranded conductor for larger than No. 10 AWG.

G. Plenum rated cable for all cables above the ceiling.

2.3 CONNECTORS AND SPLICES

A. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 "Wire and Insulation Applications" Article.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRE AND INSULATION APPLICATIONS

A. Service Entrance: Type RHW or THWN, in raceway.

B. Feeders: Type 75C insulation THHN/THWN, in raceway.

C. Fire-Pump Feeder: Type MI, 3-conductor.

D. Branch Circuits: Type THHN/THWN, in raceway.

E. Fire Alarm Circuits: Type THHN/THWN, in raceway.

F. Class 1 Control Circuits: Type THHN/THWN, in raceway.

G. Class 2 Control Circuits: Type THHN/THWN, in raceway.

H. Equipment or any device rated 100 amperes or less, conductor shall be rated 60C as per National Electrical Code.

I. Equipment or any device rated over 100 amperes, conductor shall be rated 75C as per National Electrical Code.

3.3 INSTALLATION

A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation."

B. Remove existing wires from raceway before pulling in new wires and cables.

C. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow

surface contours where possible.

F. Support cables according to Section "Basic Electrical Materials and Methods."

G. Seal around cables penetrating fire-rated elements according to Section "Firestopping."

H. Identify wires and cables according to Section "Basic Electrical Materials and Methods."

I. Identify wires and cables according to Section "Electrical Identification."

3.4 CONNECTIONS

A. Conductor Splices: Keep to minimum.

B. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.

C. Use splice and tap connectors compatible with conductor material.

D. Use oxide inhibitor in each splice and tap connector for aluminum conductors.

E. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

F. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.

G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

A. Testing: On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

B. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes grounding and bonding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

B. Related Sections include the following:

1. List below only products, construction, and equipment that the reader might expect to find in this Section but are specified elsewhere.
2. Section "Underground Ducts and Utility Structures" for ground test wells.

1.3 SUBMITTALS

A. Revise this Article to suit Project and office practice. Frequently, no product submittal is required for this Section.

B. Product Data: For each type of product indicated.

C. Retain paragraph above if Product Data are required for each product specified. Retain paragraph below if Product Data are required only for selected products.

D. Product Data: For the following:

1. Ground rods.
2. Chemical rods.
3. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

E. Field Test Reports: Submit written test reports to include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.4 QUALITY ASSURANCE

A. Retain paragraph and subparagraph below if Contractor or manufacturer selects testing agency. Delete if Contractor is allowed to perform ground-resistance testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1. Comply with UL 467.

C. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.

D. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Retain above for nonproprietary or below for semiproprietary Specification. Refer to Division 1 Section "Materials and Equipment."

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. See Editing Instruction No. 1 in the Evaluations for cautions about naming products and manufacturers.

2. Grounding Conductors, Cables, Connectors, and Rods:

a. Apache Grounding/Erico Inc.

b. Boggs, Inc.

c. Chance/Hubbell.

d. Copperweld Corp.

e. Dossert Corp.

f. Erico Inc.; Electrical Products Group.

g. Framatome Connectors/Burndy Electrical.

h. Galvan Industries, Inc.

i. Hastings Fiber Glass Products, Inc.

j. Ideal Industries, Inc.

k. ILSCO.

l. Kearney/Cooper Power Systems.

m. Korns: C. C. Korns Co.; Division of Robroy Industries.

n. Lightning Master Corp.

o. Lyncole XIT Grounding.

p. O-Z/Gedney Co.; a business of the EGS Electrical Group.

q. Raco, Inc.; Division of Hubbell.

r. Robbins Lightning, Inc.

s. Salisbury: W. H. Salisbury & Co.

t. Superior Grounding Systems, Inc.

u. Thomas & Betts, Electrical.

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Section "Conductors and Cables."

B. If only copper conductors are permitted in Division 16 Section "Conductors and Cables," delete paragraph below.

C. Material: copper.

D. Equipment Grounding Conductors: Insulated with green-colored insulation.

E. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

F. Grounding Electrode Conductors: Stranded cable.

G. Underground Conductors: stranded, unless otherwise indicated.

H. Sizes and types below are typical. Adjust to suit Project conditions and requirements.

I. Copper Bonding Conductors: As follows:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch (6.4 mm) in diameter.
2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.
4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.

J. Delete paragraph and subparagraphs below if use of aluminum conductors is not permitted.

K. Ground Conductor and Conductor Protector for Wood Poles: As follows:

1. No. 4 AWG minimum, soft-drawn copper conductor.
2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir, or cypress or cedar.

L. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.3 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.4 GROUNDING ELECTRODES

A. Copper-clad steel is most common. See Evaluations for discussion on where other materials might be more appropriate.

B. Ground Rods: Copper-clad steel.

1. Select paragraph above or paragraph and subparagraph below. Sectional types are used when rods longer than 10 feet (3 m) are installed.
2. Size: 3/4 by 120 inches (19 by 3000 mm) in diameter.

C. Chemical Electrodes: Copper tube, straight or L-shaped, filled with nonhazardous chemical salts, terminated with a 4/0 bare conductor. Provide backfill material recommended by manufacturer.

D. Test Wells: Provide handholes as specified in Section "Underground Ducts and Utility Structures."

PART 3 - EXECUTION

3.1 APPLICATION

A. Delete paragraph below if only copper conductors are specified in Division 16 Section "Conductors and Cables."

B. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

C. In raceways, use insulated equipment grounding conductors.

D. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.

E. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

F. Ground Rod Clamps at Test Wells: Use bolted pressure clamps with at least two bolts.

G. Delete paragraph and subparagraphs below if grounding bus is not required, or edit to suit Project.

H. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
   1. Use insulated spacer; space 1 inch (25.4 mm) from wall and support from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
   2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.

I. Edit below to suit Project.

J. Underground Grounding Conductors: Use tinned copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade or bury 12 inches (300 mm) above duct bank when installed as part of the duct bank.

3.2 EQUIPMENT GROUNDING CONDUCTORS

A. NEC permits two basic types of equipment grounding conductors: metallic raceway or cable sheath as the conductor, or a separate equipment grounding conductor. The installation of an equipment grounding conductor provides an additional degree of safe operation when compared to relying on raceway as the conductor. Revise paragraphs and subparagraphs in this Article to suit Project.

B. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

C. Install equipment grounding conductors in all feeders and circuits.

D. Select paragraph above or paragraph and subparagraphs below.

E. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle circuits.
   4. Single-phase motor and appliance branch circuits.
   5. Three-phase motor and appliance branch circuits.
   6. Flexible raceway runs.
   7. Armored and metal-clad cable runs.

F. Busway Supply Circuits: Install insulated equipment grounding conductor from the grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

G. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.

H. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

I. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate equipment grounding conductor. Isolate equipment grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

J. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

K. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.

L. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.

M. Coordinate paragraph and subparagraphs below with Drawings and Specification Sections for systems referenced. Edit to suit Project.

N. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6.4-by-50-by-300-mm) grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

O. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

3.3 INSTALLATION

A. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.

1. Drive ground rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

F. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

G. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

H. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor.

I. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, Paragraph 250-81(c), using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG. If

concrete foundation is less than 20 feet (6 m) long, coil excess conductor within the base of the foundation. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

3.4 CONNECTIONS

A. Coordinate paragraph and subparagraphs below with Drawings.

B. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

C. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

D. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

E. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

F. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.

G. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

H. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

I. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.5 FIELD QUALITY CONTROL

A. Retain one of three paragraphs below.

B. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure

ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.

3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
   a. NFPA 70 has minimum value of 25 ohms. See Evaluations for discussion on appropriate grounding resistance values. Values listed below are typical; adjust to suit Project conditions.
   b. Equipment Rated 500 kVA and Less: 10 ohms.
   c. Equipment Rated 500 to 1000 kVA: 5 ohms.
   d. Equipment Rated More Than 1000 kVA: 3 ohms.
   e. Substations and Pad-Mounted Switching Equipment: 5 ohms.
   f. Manhole Grounds: 10 ohms.
4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

3.6 GRADING AND PLANTING

A. Delete below if inappropriate or if surface restoration work is covered on Drawings or in Division 2 Sections. Coordinate with Drawings.

B. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions and Specification sections, apply to work covered by this Section.

B. Comply with this sections, as applicable. Refer to other sections for coordination of work.

1.2 SCOPE OF WORK

A. Provide labor, material, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of supporting devices, including related systems and accessories.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Unistrut Corp.

B. B-Line Systems, Inc.

C. Midland Ross-Kindorf

2.2 MATERIALS

A. Suspension Hangers

1. Suspension hangers for individual conduit runs shall be zinc plated formed steel type.

B. Vertical Supports

1. Malleable iron one hole pipe straps shall be used for vertical runs

C. Clamps

1. Beam clamps shall be used for bar joists and beams.

D. Anti-Vibration Hangers

1. Anti-vibration hangers shall be combination type having a double deflection neoprene element in series with a steel coil spring; double deflection of 0.30"; steel coil spring shall be selected from a 1" static deflection series with a minimum additional travel to solid of ½"; spring diameters shall be large enough to permit 15 degree angular misalignment of the rod connecting the hanger to the ceiling support without rubbing the hanger box.

2.3 LIGHT FIXTURE HANGERS

A. Refer to Section 26 51 00

B. Corrosive Areas: PVC; at factory apply a minimum of 10-mil-thick PVC coating, bonded to metal, inside and outside. Z

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hangers

1. Approved hangers and stiff leg supports shall be installed in quantity and size as required to carry the weight of raceway and contents and shall be arranged to prevent vibration transmission to the building and allow for raceway movement.
2. Hangers shall be supported by means of uncoated solid steel rods which are threaded to allow vertical adjustments. Lock nuts shall be provided in sufficient number and location to lock all rod adjustments permanently at the adjusted height. Two lock nuts shall be used unless the nut tightens against a threaded socket. Minimum rod diameters shall be as follows:

B. NOMINAL CONDUIT SIZE ROD DIAMETER

1/2" through 2”	1/4"	
2-1/2" through 3”	3/8"	4" and 5” 1/2"

1. Hanger spacing shall be as required for proper and adequate support raceway, but in no case shall be less than one hanger per 8'-0" of raceway length except that conduit less than 1" diameter shall be supported at least every 6'-0".
2. Where numerous conduits are run parallel to one another, they may be supported from a trapeze type hanger arrangement with strut bottom.
3. Anti-vibration type hangers shall be provided for equipment as required to minimize vibration and/or as directed by the Architect/Engineer.

Supports

4. Support of hangers shall be by means of sufficient quantities of individual after set steel expansion shields, or beam clamps attached to structural steel.
5. Stiff-legs shall be furnished and installed in cases where support from overhead structure is not possible.
6. Ceiling mounted lighting fixtures shall be supported from the building structure at two opposite corners. The Contractor shall provide fixture hangers to properly interface with the ceiling system.
7. Furnish and install complete any additional structural support steel, brackets, fasteners, etc., as required to adequately support all raceway and equipment.
8. Support of hangers from concrete slabs shall be by means of sufficient quantity of "U" brackets attached with after set expansion shields and bolts.
9. Support of hangers from concrete tees shall be by means of sufficient quantity of angle iron brackets attached with after set expansion shields and bolts.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
   1. Edit lists below to suit Project.
   2. Raceways include the following:
      a. RMC.
      b. IMC.
      c. PVC externally coated, rigid steel conduits.
      d. PVC externally coated, IMC.
      e. EMT.
      f. FMC.
      g. LFMC.
      h. LFNC.
      i. RNC.
      j. ENT.
      k. Wireways.
      l. Surface raceways.
   3. Boxes, enclosures, and cabinets include the following:
      a. Device boxes.
      b. Floor boxes.
      c. Outlet boxes.
      d. Pull and junction boxes.
      e. Cabinets and hinged-cover enclosures.

B. Related Sections include the following:
   1. List below only products and equipment for this Project that the reader might expect to find in this Section but are specified elsewhere. Verify that Section titles listed below are correct for this Project's Specifications because Section titles may have changed since this Section was updated.
   2. Section "Basic Electrical Materials and Methods" for raceways and box supports.
   3. Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. FMC: Flexible metal conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquidtight flexible metal conduit.

F. LFNC: Liquidtight flexible nonmetallic conduit.

G. RMC: Rigid metal conduit.

H. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Delete below except for custom enclosures.

C. Shop Drawings: Include layout drawings showing components and wiring for nonstandard boxes, enclosures, and cabinets.

1.5 QUALITY ASSURANCE

A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

B. Comply with NECA's "Standard of Installation."

C. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Retain above for nonproprietary or below for semiproprietary Specification. Refer to Division 1 Section "Materials and Equipment."

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Metal Conduit and Tubing:

a. Alflex Corp.

b. Anamet, Inc.; Anaconda Metal Hose.

c. Anixter Brothers, Inc.

d. Carol Cable Co., Inc.

e. Cole-Flex Corp.

f. Electri-Flex Co.

g. Flexcon, Inc.; Coleman Cable Systems, Inc.

h. Grinnell Co.; Allied Tube and Conduit Div.

i. Monogram Co.; AFC.

j. Spiraduct, Inc.

k. Triangle PWC, Inc.

l. Wheatland Tube Co.

2. Nonmetallic Conduit and Tubing:

a. Anamet, Inc.; Anaconda Metal Hose.

b. Arnco Corp.

c. Breeze-Illinois, Inc.

d. Cantex Industries; Harsco Corp.
e. Certainteed Corp.; Pipe & Plastics Group.
f. Cole-Flex Corp.
g. Condux International; Electrical Products.
h. Electri-Flex Co.
i. George-Ingraham Corp.
j. Hubbell, Inc.; Raco, Inc.
k. Lamson & Sessions; Carlon Electrical Products.
l. R&G Sloan Manufacturing Co., Inc.
m. Spiraduct, Inc.
n. Thomas & Betts Corp.

3. Conduit Bodies and Fittings:
   a. American Electric; Construction Materials Group.
   b. Crouse-Hinds; Div. of Cooper Industries.
   c. Emerson Electric Co.; Appleton Electric Co.
   d. Hubbell, Inc.; Killark Electric Manufacturing Co.
   e. Lamson & Sessions; Carlon Electrical Products.
   f. O-Z/Gedney; Unit of General Signal.
   g. Scott Fetzer Co.; Adalet-PLM.
   h. Spring City Electrical Manufacturing Co.
4. Metal Wireways:
   a. Hoffman Engineering Co.
   b. Keystone/Rees, Inc.
   c. Square D Co.

2.2 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.
B. Rigid Aluminum Conduit: ANSI C80.5.
C. IMC: ANSI C80.6.
D. EMT and Fittings: ANSI C80.3.
   1. Fittings: Set-screw type.
E. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

2.3 NONMETALLIC CONDUIT AND TUBING

A. RNC: NEMA TC 2, Schedule 40 or 80 PVC.
B. RNC Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.
C. LFNC: UL 1660.

2.4 METAL WIREWAYS

A. Material: Sheet metal sized and shaped as indicated.
B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
D. Select 1 of 4 paragraphs below.
E. Wireway Covers: Screw – cover type flanged-and-gasketed type.

F. Finish: Manufacturer's standard enamel finish.

2.5 OUTLET AND DEVICE BOXES

A. Sheet Metal Boxes: NEMA OS 1.

B. Edit paragraph below. Aluminum is also available and suitable for use with steel raceways.

C. Cast-Metal Boxes: NEMA FB 1, Type FD, cast box with gasketed cover.

2.6 PULL AND JUNCTION BOXES

A. Small Sheet Metal Boxes: NEMA OS 1.

B. Cast-Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

2.7 ENCLOSURES AND CABINETS

A. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.

B. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS

A. Use a comprehensive wiring method schedule on Drawings or use this Article to specify where various raceway types are to be installed. Edit examples below, adding or deleting materials and methods to suit Project. Coordinate with Division 16 Section "Wires and Cables." Do not duplicate information on Drawings, in NFPA 70, or in other Division 16 Sections. List exceptions to stated requirements. Check code to avoid specifying uses not permitted.

B. Outdoors: Use the following wiring methods:

1. Exposed: Rigid steel.
2. Concealed: Rigid steel.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R .

C. Indoors: Use the following wiring methods:

1. Exposed: EMT.
2. Concealed: EMT.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.
6. Damp or Wet Locations: Rigid steel conduit.
7. Boxes and Enclosures: NEMA 250, Type 1, except as follows:

a. Select 1 of 2 subparagraphs below and add other specific box and enclosure requirements to suit Project.
b. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

3.3 INSTALLATION

A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.

B. Select paragraph above or below.

C. Minimum Raceway Size: 3/4-inch trade size (DN21).

D. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.

E. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

F. Install raceways level and square and at proper elevations. Provide adequate headroom.

G. Complete raceway installation before starting conductor installation.

H. Support raceways as specified in Section "Basic Electrical Materials and Methods."

I. Use temporary closures to prevent foreign matter from entering raceways.

J. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

K. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

L. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.

M. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.

N. Raceways Embedded in Slabs (Must be indicated on drawings to be embedded. Please notify Engineer if required but not shown): Install in middle third of slab thickness where practical, and leave at least 1-inch (25-mm) concrete cover.
1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
2. Space raceways laterally to prevent voids in concrete.
3. Run conduit larger than 1-inch trade size (DN27) parallel to or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.

O. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
1. Run parallel or banked raceways together, on common supports where practical.
2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

P. Join raceways with fittings designed and approved for the purpose and make joints tight.
1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
2. Use insulating bushings to protect conductors.

Q. Tighten set screws of threadless fittings with suitable tools.

R. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.

S. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

T. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.

U. Telephone and Signal System Raceways, 2-Inch Trade Size (DN53) and Smaller: In addition to the above requirements, install raceways in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

V. Delete paragraph below if not applicable.

W. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as the boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

X. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches (150 mm) above the floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.

Y. Flexible Connections: Use maximum of 6 feet (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.

Z. Delete paragraph below if no high-frequency installation.

AA. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in a nonmetallic sleeve.

BB. Do not install aluminum conduits embedded in or in contact with concrete.

CC. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

DD. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying the raceways to receptacle or fixture ground terminals.

1. Select each surface raceway outlet box, to which a lighting fixture is attached, of sufficient diameter to provide a seat for the fixture canopy.
2. Where a surface raceway is used to supply a fluorescent lighting fixture having central-stem suspension with a backplate and a canopy (with or without extension ring), no separate outlet box is required.
3. Provide surface metal raceway outlet box, and the backplate and canopy, at the feed-in location of each fluorescent lighting fixture having end-stem suspension.
4. Where a surface metal raceway extension is made from an existing outlet box on which a lighting fixture is installed, no additional surface-mounted outlet box is required. Provide a backplate slightly smaller than the fixture canopy.

EE. Set floor boxes level and adjust to finished floor surface.

FF. Select paragraph above for metal floor boxes and below for nonmetallic floor boxes.

GG. Set floor boxes level and trim after installation to fit flush to finished floor surface.

HH. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

II. NO PVC CONDUIT ALLOWED ABOVE THE CEILING OR IN THE A/C RETURN PLENUM. PROVIDE RIGID CONDUIT. Verify all MEP documents.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.5 CLEANING

A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION

SECTION 26 05 43

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART1 -GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions and Specification sections, apply to work covered by this Section.

1.2 SCOPE OF WORK

A. Provide labor, materials, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of all site electrical work.

B. The site electrical work shall include, but not be limited to, the furnishing and installation of necessary materials and making arrangements for:

1. The connection of electrical and telephone utilities.
2. Underground conduit.

1.3 SUBMITTALS

A. Submit product data and shop drawings in accordance with Section for products specified under PARTS 2 PRODUCTS.

1.4 REFERENCE STANDARDS

A. National Electrical Code (NEC), Article 300

B. Service installation standards of the serving utility company(s).

PART 2 - PRODUCTS

2.1 ELECTRICAL SERVICE

A. Coordination: The location of the service entrance shall be coordinated with all other trades. Provide materials and equipment required to connect the electrical service. Contractor shall coordinate with the Power Company for all requirements prior to bid date. Contractor shall include all cost to for Utility Company to extend service to project site bid.

B. Materials: Provide materials in accordance with other Sections of these Specifications.

2.2 COMMUNICATION SERVICE

A. Coordination: The location of the telephone, cable, and internet service entrance shall be coordinated with all other trades. Provide materials and equipment required to connect the telephone, cable and internet services. Contractor shall coordinate with the Telephone , cable, and internet company for all requirements prior to bid date. Contractor is responsible to coordinate with utility companies.

B. Materials: Provide materials in accordance with other sections of this specification.

PART 3 - EXECUTION

3.1 GENERAL

A. Underground installation of more than one conduit shall be in a duct arrangement as indicated. All conduits shall be laid so joints are staggered. All bends and stub-ups shall be rigid steel.

B. Pour a red colored concrete envelope 3" thick over utility service, emergency generator and fire pump conduits. Where conduits cross a driveway, road or parking area, reinforcing rods shall be installed.

C. Perform excavation, shoring, backfilling and concrete work in connection with electrical work in accordance with other sections of the Specifications.

D. All conduit shall be sloped away from the building to negate water entering the building through the conduit system.

3.2 UTILITIES

A. The locations, elevations and voltage of electrical lines and the location of the telephone lines included within the area of this work are indicated on the Drawings or in the Specifications in accordance with information received by the Architect/Engineer and Owner.
B. The Contractor shall examine the site and shall verify, to his own satisfaction, the location and elevation of all utilities, and shall adequately inform himself as to their relation to the work.
C. Existing utility lines not indicated but encountered during construction shall be protected, relocated or capped as directed by the Architect/Engineer. All precautions shall be exercised to prevent damage to existing lines not shown, but should work become necessary, it must be authorized prior to execution except in an emergency situation.
D. Before beginning excavations of any nature whatsoever, the Contractor shall make an attempt to locate all underground utilities of every nature occurring within the bounds of the area to be excavated. Contractor is responsible to call 811 prior to any work. The Contractor shall then proceed with caution in his excavation work so that no utility shall be damaged with a resultant loss of service.
E. Should a damage result to any utility through the Contractor's negligence or failure to comply with the above directive, he shall be liable for such damage and for all expense incurred in the expeditious repair or replacement of such damaged utilities.
F. Repair of damaged utilities shall be to a condition equal to or better than the adjacent undamaged portion of such utility and to the complete satisfaction of the Architect/Engineer and Owner.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions and Specification sections, apply to work covered by this Section.

B. Comply with ELECTRICAL Sections, as applicable. Refer to other sections for coordination of work.

1.2 SCOPE OF WORK

A. Provide labor, material, equipment, tools and services, and perform operations required for, and reasonably incidental to,

B. Provide electrical identification for the following:

1. Panelboards, motor starters, contactors, disconnect switches, circuit breakers and other electrical equipment with nameplate identifying the item of equipment and the equipment serving the same.
2. Raceways, junction boxes and pull boxes.
3. Label each panelboard index indicating the room #s to the related circuit. Also add the index sheet in a laminated white core, plastic with beveled edges, minimum 1/16 inch thick. Lettering shall be machine-engraved, not less than 1/4" high, cut through the black or red surface to the white core.
4. Wiring devices.
5. Wiring.
6. Three phase motor rotation.

1.3 SUBMITTALS

A. Submit product data in accordance with Section for products specified under PART 2 - PRODUCTS.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Brady
B. Panduit
C. Thomas & Betts
D. Seton

2.2 IDENTIFICATION

A. Nameplates

1. Nameplates shall be black engraved surface on white core for normal power circuits and red engraved surface on white core for emergency power circuits.
2. Provide for each distribution panelboard, branch circuit panelboard, transformer and any other similar equipment furnished under this section identification as to its given name, voltage and origination of service. Examples are as follows:

‘LR1’	‘LR2’
120/240V	120/240V
FED FROM ‘MDP’	FED FROM ‘MDP’

3. Provide for each motor starter enclosure, circuit breaker enclosure, disconnect switch and any other similar

equipment furnished under this section, identification as to the specific load that it serves and the origination of service. Examples are as follows:

‘AHU-1' ‘CU-1'
FED FROM ‘MDP' FED FROM ‘MDP’

1. Provide for each feeder protective device in each distribution panelboard and any other similar equipment furnished under this section, identification as to the specific load that it serves.
2. Nameplates shall be laminated, white core, plastic with beveled edges, minimum 1/16 inch thick. Lettering shall be machine-engraved, not less than 1/4" high, cut through the black or red surface to the white core.

B.Junction Boxes and Pull Boxes

1. 1. Identification shall be with a black permanent marking pen on the top of 4" x 4" junction box covers or on the back of an outlet box cover plate identifying the branch circuits and systems within the conduit. Pull boxes shall be provided with a nameplate stating voltage and system served.

C.Wiring Device Wall Plates

1. 1. On the back side of wiring device wall plates identify with a black permanent marking pen the panelboard and branch circuit number the device is served from.

D. Wire Markers

2. 1. Wire markers for identification of wiring shall be self-adhesive type having letters and numerals indicating serving equipment and feeder or branch circuit number.

Rotation Tags

1. Rotation tags shall be brass or aluminum securely attached to equipment.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surfaces to receive labels or nameplates shall be carefully prepared in accordance with the manufacturer's instructions and recommendations.

3.2 NAMEPLATES

A. Nameplates shall be properly attached to identify panelboards, feeder circuit breakers, disconnect switches, pull boxes and other similar equipment furnished under this section.

3.3 WIRE MARKERS

A. Wire markers shall be applied to each conductor or cable within panelboards, motor starter enclosures, circuit breaker enclosures, disconnect switches, cabinets, junction boxes, pull boxes, and other similar equipment identifying the serving equipment and feeder or branch circuit from which the conductors originate.

END OF SECTION

SECTION 26 05 73.13

SHORT-CIRCUIT STUDIES

1.1 SUMMARY

A. Section includes a computer-based, short-circuit study to determine the minimum required short-circuit ratings for all electrical equipment.

1.2 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled. Existing to remain items shall remain functional throughout the construction period.

B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.

D. Power Systems Analysis Specialist: Professional or qualified engineer in charge of performing the study and documenting recommendations.

E. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.

F. SCCR: Short-circuit current rating.

G. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

H. Single-Line Diagram: See "One-Line Diagram."

1.3 ACTION SUBMITTALS

A. Product Data:

1. Submit information on computer software program to be used for studies.
2. Submit the following after the approval of system submittals. Submittals [shall] [may] be in digital form.

a. Short-circuit study input data, including completed computer program input data sheets.
b. Short-circuit study and equipment duty evaluation report; signed and dated by a professional or qualified engineer.

1) Submit study report for action prior to receiving final approval of distribution equipment submittals. If completion of studies will cause delay in equipment manufacturing, obtain approval from Owner for preliminary submittal of sufficient accuracy to ensure that selection of devices and associated characteristics is satisfactory. All assumptions made in a preliminary submittal shall be clearly identified.

2) Revised one-line diagram, reflecting any discrepancies noted or updates required based on data collected for the study.
3) Study report shall include documentation of all equipment data used in the short-circuit and equipment duty analysis.
4) Study shall include a detailed listing of any electrical equipment found to be underrated for the calculated fault duty.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Power Systems Analysis Software.
2. For Power System Analysis Specialist.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. Final Short-Circuit Study Report:

a. Final one-line diagram.
b. Final Equipment Duty Report.
c. Short-circuit study data files.
d. Power system data.
e. Software data file in electronic format compatible with the software version used in the study.
f. Software library data used for the study.

1.6 QUALITY ASSURANCE

A. Study shall be performed using commercially developed and distributed electrical power system analysis software.

B. Software algorithms and methodology shall comply with requirements of applicable standards and guides specified in this Section.

C. Manual calculations are unacceptable.

1. Power System Analysis Software Qualifications: Computer program shall be designed to perform ANSI and IEC based short-circuit studies or have a function, component, or add-on module designed to perform short-circuit studies.

D. Power Systems Analysis Specialist Qualifications: Professional Engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this Professional Engineer.

E. Short-Circuit Study Certification: Short-Circuit Study Report shall be signed by Power Systems Analysis Specialist.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide EasyPower, LLC software with ANSI ShortCircuit, IEC ShortCircuit, Scenario Manager, SmartDuty and SmartBreaker or comparable product by one of the following:

1. CGI CYME.
2. Power Analytics, Corporation.
3. <Insert manufacturer's name>.

B. Comply with IEEE 399 and IEEE 551.

1. Analytical features of power systems analysis software program shall have capability as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary of study findings.

B. Detailed list of all electrical equipment found to be underrated for the available short-circuit current.

C. Recommendations for resolving any issues found with underrated equipment.

D. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

E. One-line diagram of modeled power system, indicating the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer size and impedance.
4. Motor and generator designations and ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
6. Any revisions to electrical equipment required by the study.

F. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment short-circuit ratings exceed available short-circuit current based on the applicable standards.
2. Tabulations of circuit breaker, fuse, and other protective device short-circuit ratings versus calculated short-circuit duties.
3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

G. Short-Circuit Study Input Data:

1. One-line diagram of system being studied.

2. Utility or incoming power short-circuit data.
3. Manufacturer, model, and short-circuit rating of protective devices.
4. Conductors.
5. Transformer data.

H. Short-Circuit Study Output Reports:

1. Low-Voltage Fault Report: Three-phase and single line to ground fault calculations, indicating the following for each overcurrent device location:

    a. Voltage.
    b. Calculated fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. Multiplying factor.

2. High-Voltage Momentary Short-Circuit Report: Three-phase and single line to ground fault calculations, indicating the following for each equipment location:

    a. Voltage.
    b. Calculated symmetrical fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. Calculated asymmetrical fault currents:

        1) Based on fault-point X/R ratio.
        2) Based on calculated symmetrical value multiplied by 2.6.

3. High-Voltage Interrupting Short-Circuit Report: Three-phase and single line to ground fault calculations, indicating the following for each equipment location:

    a. Voltage.
    b. Calculated symmetrical fault-current magnitude and angle.
    c. Fault-point X/R ratio.
    d. No AC Decrement (NACD) ratio.

4. Equipment Duty Report: For each protective device, indicate short-circuit ratings and calculated equipment duty for both ½ cycle and interrupting ratings as applicable. Calculated duty must automatically take into account any necessary derating factor due to the system X/R ratio and based on the actual maximum fault current through each device rather than the total bus fault current. All calculations to be based on the specific applicable test standards for each device such that no further interpretation of the results is necessary.

PART 3 - EXECUTION

3.1 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the study.

1. Verify completeness of data supplied on one-line diagram. Call any discrepancies to Owner's attention.
2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.

3. For [equipment that] [relocated equipment and that which] is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers.

B. Gather and tabulate the required input data to support the short-circuit study. Comply with requirements in Section 017839 "Project Record Documents" for recording circuit protective device characteristics. Record data on a Record Document copy of one-line diagram. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or their representative. Data must include, but not be limited to, the following:

1. Product Data for Project's overcurrent protective devices. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at each service from the serving utility.
3. For transformers, include kVA ratings, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
4. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
5. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
6. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
7. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
8. Motor horsepower and NEMA MG 1 code letter designation.
9. Conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

3.2 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents in accordance with IEEE 551.

C. Base study on device characteristics supplied by device manufacturer.

D. Extent of electrical power system to be studied is indicated on Drawings.

E. Begin the scope of the short-circuit current and equipment duty analysis at the service, extending down to system overcurrent protective devices as follows:

1. Down to and including all three-phase panelboards at voltages 208 V ac or higher.
2. <Insert description>.

F. For systems with multiple sources or multiple operating conditions, evaluate short-circuit and equipment duty for multiple scenarios as necessary to determine the maximum short-circuit current at each location.

G. Analysis software must factor in ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply this to the short-circuit and equipment duty calculations as recommended by applicable standards. Also account for the fault-current dc decrement to address asymmetrical current ratings of applicable electrical equipment and components.

H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.

I. Equipment duty report must clearly indicate any protective device that is being applied outside its short-circuit rating.

J. For any equipment found to be underrated, the report shall include recommendations for resolving this deficiency.

END OF SECTION

SECTION 26 05 73.19

ARC-FLASH HAZARD ANALYSIS

1.1 SUMMARY

A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard boundary distance and the incident energy to which personnel could be exposed during work on or near energized electrical equipment.

1.2 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.

D. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.

E. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

F. SCCR: Short-circuit current rating.

G. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

H. Single-Line Diagram: See "One-Line Diagram."

1.3 ACTION SUBMITTALS

A. Product Data: Submit information regarding computer software program to be used for studies.

B. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals shall be in digital form:

1. Arc-flash study report; signed, dated, and sealed by Power Systems Analysis Specialist.
2. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
3. Exported data from computer-based, one-line diagram detailing the system data used for the arc-flash calculations, provided in .csv or Microsoft Excel format.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Power Systems Analysis Software Developer.
2. For Power System Analysis Specialist.

B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.5 CLOSEOUT SUBMITTALS

A. Arc-Flash Hazard Analysis:

1. Provide final arc-flash hazard analysis report in hard copy and digital format.
2. Provide digital file containing electrical system model in a format consistent with power system analysis software used to perform study.
3. Provide library files for power system analysis software used to perform study.

1.6 QUALITY ASSURANCE

A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. Manual calculations are unacceptable.

D. Power System Analysis Software Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Computer program shall be designed to perform arc-flash analysis.

E. Power Systems Analysis Specialist Qualifications: Professional or qualified engineer in charge of performing the arc-flash study, analyzing the arc-flash results, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional or qualified engineer.

F. Arc-Flash Study Certification: Arc-Flash Study Report shall be signed and sealed by Power Systems Analysis Specialist.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide software developed and sold by EasyPower software with ANSI ShortCircuit, ArcFlash, PowerProtector, Scenario Manager, SmartDuty and SmartBreaker or comparable product by one of the following:

1. CGI CYME.

2. Power Analytics, Corporation.

B. Software must provide results consistent with the requirements of the latest versions of IEEE 1584 and NFPA 70E.

C. Software capable of creation and storage of unlimited number of operating scenarios. All scenarios stored in the same project model file. System changes made to the base case automatically propagated to each operating scenario.

2.2 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram, indicating the following:

1. Protective device designations, locations, and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.
6. Utility sources.

D. Study Input Data: As described in "Power System Data" Article.

E. Equipment Duty Report: As specified in Section 260573.13 "Short-Circuit Studies."

F. Data on all protective devices; manufacturers, types, sizes and adjustable settings that were used for the arc-flash calculations.

G. List of protective devices found to be inoperable or with signs of impending failure. These devices must be clearly listed and excluded from use in determination of the arc time.

H. Equipment Duty Study: Report to verify that all protective devices have adequate short-circuit ratings to interrupt the calculated maximum short-circuit current.

I. Arc-Flash Study Calculations and Output Reports:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.
5. Restricted approach boundary.
6. Limited approach boundary.
7. Working distance.
8. Incident energy.

J. Arc-Flash Study input data, scenario descriptions, and arc-flash calculations including a definition of terms and guide for interpretation of the arc-flash hazard report. Study input data must be provided in electronic form as .csv or Excel files.

2.3 ARC-FLASH WARNING LABELS

A. Provide a weatherproof, self-adhesive equipment label for each location requiring arc-flash hazard identification.

1. Minimum Size: 6 inches (150 mm) wide by 4 inches (100 mm) high.
2. Sample label submitted for review prior to printing of actual labels.

B. Content: Orange header with the wording, "WARNING, ARC-FLASH HAZARD, Arc-Flash and Shock Risk Assessment, Appropriate PPE Required." and the following information taken directly from the arc-flash hazard analysis:

1. Equipment ID.
2. Nominal voltage.
3. Protection boundaries.
    a. Arc-flash boundary.
    b. Restricted approach boundary.
    c. Limited approach boundary.
4. Available incident energy.
5. Working distance.
6. Engineering report number, revision number, and issue date.

C. Completely machine printed, no field-applied markings.

D. Compliance: NFPA 70E.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project electrical equipment submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study. The report shall clearly state any assumptions that were necessary to complete the analysis.

3.2 ARC-FLASH HAZARD ANALYSIS

A. Comply with the latest versions of NFPA 70E for the arc-flash hazard analysis study.

B. Study all operating scenarios to determine the maximum incident energy at each location.

C. Submit proposed arc-flash analysis scenarios for review prior to performing arc-flash calculations. Arc-flash hazard analysis report shall indicate which scenario created the maximum arc-flash energy for each location. All arc-flash calculations must be performed in accordance with the procedures and recommendations contained in the latest version of IEEE 1584. Calculate the arc-flash hazard boundary and incident energy at all locations in electrical distribution system where personnel could service or examine equipment while energized.

D. Include all three-phase medium- and low-voltage equipment locations.

E. Calculate the limited and restricted approach boundaries for each location.

F. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources or fault current that changes with time during the fault. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented based on the recommendations in IEEE 399 and ANSI C37 where applicable.

G. Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for both line and load side of a circuit breaker as follows:

1. When the circuit breaker is in a separate enclosure.
2. When the line terminals of the circuit breaker are separate from the work location.

H. Base arc-flash calculations on the time-current curve or operating time of the fastest upstream device using the predicted arcing current through that device. For medium-voltage circuit breakers, the breaker interrupting time must be automatically added to the relay operating time. Based on the recommendations in IEEE 1584 and sound engineering judgment, a maximum arc time of two seconds can be applied for situations where the protective device operating time is found to exceed two seconds.

3.3 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the arc-flash hazard analysis.

1. Verify completeness of data supplied on one-line diagram on Drawings. Call any discrepancies or missing information to Owner's attention.
2. For new equipment, use characteristics from approved submittals under provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys conducted by qualified technicians and engineers.

B. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer. Data shall include, but are not limited to, the following:

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance or available short-circuit current at each service.
3. Short-circuit current at each system bus (three phase and line to ground).
4. Voltage level at each bus.
5. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio if available, tap settings, and phase shift.
6. For reactors, provide manufacturer and model designation, voltage rating and impedance.
7. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, short-circuit rating, continuous current rating, and settings for all adjustable settings.
8. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.

9. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
10. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
11. Motor horsepower.
12. Low-voltage conductor sizes, lengths, number, conductor material, and conduit material.
13. Medium-voltage conductor sizes, lengths, conductor material, conductor construction and metallic shield performance parameters, and conduit material.

3.4 LABELING

A. Apply one arc-flash label on the front cover of each section of the equipment and on side or rear covers with accessible live parts and hinged doors or removable plates for each equipment included in the study. Base arc-flash label data on highest values calculated at each location.

B. Each piece of equipment listed below shall have an arc-flash label applied to it:

1. Motor-control center.
2. Low-voltage switchboard.
3. Switchgear.
4. Medium-voltage switch.
5. Low voltage transformers.
6. Panelboard.
7. Safety switch.
8. Fused disconnect switch.
9. Enclosed circuit breaker.
10. Adjustable frequency drive.
11. Control panel.

3.5 APPLICATION OF WARNING LABELS

A. Install arc-flash warning labels under the direct supervision and control of Power System Analysis Specialist.

3.6 DEMONSTRATION

A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in potential arc-flash hazards associated with working on energized equipment and the interpretation of arc-flash warning labels.

END OF SECTION

SECTION26 09 23

LIGHTING CONTROL SYSTEM

PART 1 – GENERAL

1.0 SECTION INCLUDES

A. Network lighting control system and components:
    1. Touch panel controls
    2. Lighting management panels
    3. Lighting management modules
    4. Low voltage wall stations
    5. Power interfaces
    6. Wired sensors

1.1. RELATED DOCUMENTS

A. Section 262726 Wiring Devices
B. Section 260923 Lighting Control Devices
C. Section 260943.13 Digital-Network Lighting Controls
D. Section 260943.16 Addressable Fixture Lighting Control
E. Section 260943.19 Wireless Network Lighting Controls
F. Section 265113 Interior Lighting Fixtures

1.2. SUMMARY

A. The lighting control system specified in this section shall provide time-based, sensor-based (both occupancy and daylight), and manual lighting control
B. The system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed). Specific dimmers will be capable of "dimming lights to off"
C. All system devices shall be networked together, enabling digital communication between devices, and shall be individually addressed.
D. The system architecture shall be capable of enabling stand-alone groups (rooms) of devices to function in some default capacity, even if network connectivity to the greater system is lost.
E. The system architecture shall facilitate remote operation via a computer connection.
F. The system shall not require any centrally hardwired switching equipment.
G. The system shall be capable of wireless, wired, or hybrid wireless/wired architectures.

1.3 SUBMITTALS

A. Product Datasheets (general device descriptions, dimensions, electrical specifications, wiring details, nomenclature)
B. Riser Diagrams – typical per room type (detailed drawings showing device interconnectivity of devices)
C. Other Diagrams – as needed for special operation or interaction with other system(s)
D. Example Contractor Startup/Commissioning Worksheet – must be completed prior to factory start-up
E. Hardware and Software Operation Manuals
F. Other operational descriptions as needed

1.4 PROJECT CLOSEOUT DOCUMENTATION

A. Provide a factory published manual
    1. Warranty

2. Technical support contact
3. Electronic manual on manufacturer's website for free download

1.5 QUALITY ASSURANCE

A. All steps in sensor manufacturing process shall occur in North America; including population of all electronic components on circuit boards, soldering, programming, wiring, and housing.
B. All components and the manufacturing facility where product was manufactured must be RoHS compliant.
C. In high humidity or cold environments, the sensors shall be conformably coated and rated for condensing humidity and -40 degree Fahrenheit (and Celsius) operation.
D. All applicable products must be UL / CUL Listed or other acceptable national testing organization.

1.6 PROJECT CONDITIONS

A. Only install equipment after the following site conditions are maintained:
    1. Ambient Temperature 14 to 105 degrees F (-10 to 40 degrees C)
    2. Relative Humidity less than 90% non-condensing
B. Standard electrical enclosures are permanently installed
C. Equipment is protected from dust, debris and moisture

1.7 WARRANTY

A. Five (5) year 100% parts replacement

1.8 MAINTENANCE & SUSTAINABILITY

A. Provide new parts, upgrades, and/or replacements available for a minimum of 5 years available to the end user
B. Provide free telephone technical support

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable: Acuity Brands Lighting, Inc. – System: nLight by Acuity Controls
B. Basis of controls design Manufacturer: Acuity Brands, One Lithonia Way, Conyers GA 30012, www.acuitycontrols.com
C. Substitutions: Not Permitted {Under Division 1}:
    1. All substitutions must be submitted in writing for approval at least 14 days prior to bid date.
    2. Proposed substitute products must be documented with a line by line compliance review

2.2 SYSTEM REQUIREMENTS

A. System shall have an architecture that is based upon three main concepts; 1) intelligent lighting control devices 2) standalone lighting control zones 3) network backbone for remote or time based operation.
B. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure should be permissible so as to minimize overall device count of system.
C. System must interface directly with intelligent LED luminaires such that only CAT-5 cabling is required to interconnect luminaires with control components such as sensors and switches (see *Networked LED Luminaire* section).

D. Intelligent lighting control devices shall communicate digitally, require <7 mA of current to function (Graphic wall stations excluded), and possess RJ-45 style connectors.
E. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.
F. Devices within a lighting control zone shall be connected with CAT-5e low voltage cabling in any order.
G. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.
H. Individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.
I. Power for devices within a lighting control zone shall come from either resident devices already present for switching (relay device) or dimming purposes, controls enabled luminaires, or from the network backbone. Standalone “bus power supplies” shall not be required in all cases.
J. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications that require centralized or remote switching shall be capable of being accommodated.
K. System shall have one or more primary wall mounted network control “gateway” devices that are capable of accessing and controlling connected system devices and linking into an Ethernet LAN.
L. System shall use “bridge” devices that route communication and distribute power for up to 8 directly connected lighting zones together for purposes of decreasing system wiring requirements.
M. System shall be capable of wirelessly connecting a lighting zone to a WiFi (802.11n) wireless data network for purposes of eliminating the “bridge” devices and all cabling that connects zones to bridge devices.
N. WiFi enabled devices shall be able to detect when WiFi network is down and revert to a user directed default state.
O. WiFi-enabled devices shall be capable of current monitoring
P. WiFi-enabled devices shall utilize WPA2 AES encryption
Q. WiFi-enabled devices shall be able to connect to 802.11b/g/n WiFi networks
R. WiFi-enabled devices shall have two local RJ-45 port for communicating with non WiFi-enabled system devices
S. System shall have a web-based software management program that enables remote system control, status monitoring, and creation of lighting control schedules and profiles.
T. Individual lighting zones shall be capable of being segmented into several “local” channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.
U. Devices located in different lighting zones shall be able to communicate occupancy, photocell(non-dimming), and switch information via either the wired or WiFi backbone.
V. System shall be capable of operating a lighting control zone according to several sequences of operation. System shall be able to change a spaces sequence of operation according to a time schedule so as to enable customized time-of-day, day-of-week, utilization of a space. Note: Operating modes should be utilized only in manners consistent with local energy codes.

1. Auto-On / Auto-Off (via occupancy sensors)
   • Zones with occupancy sensors automatically turn lights on when occupant is detected.
   •Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.

• Pressing a switch will turn lights off. The lights will remain off regardless of occupancy until switch is pressed again, restoring the sensor to Automatic On functionality.

2. Manual-On / Auto-Off (also called Semi-Automatic)

• Pushing a switch will turn lights on.

• Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.

3. Manual-On to Auto-On/Auto-Off

• Pushing a switch will turn lights on.

• After initial lights on, zones with occupancy and/or photocell sensors turn lights on/off according to occupancy/vacancy and/or daylight conditions.

• Sequence can be reset via scheduled (ex. daily each morning) events.

4. Auto-to-Override On

• Zones with occupancy sensors automatically turn lights on when occupant is detected.

• Zone lighting then goes into an override on state for a set amount of time, or until the next time event returns the lighting to an auto-off style of control.

• Sequence can be reset via scheduled (ex. daily each morning) events.

5. Manual-to-Override On

• Pushing a switch will turn lights on.

• Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.

• Sequence can be reset via scheduled (ex. daily each morning) events.

6. Auto On / Predictive Off

• Zones with occupancy sensors automatically turn lights on when occupant is detected.

• Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.

• Pressing the switch will turn the lights off and a short “exit timer” begins. After thetimer expires, sensor scans the room to detect whether occupant is still present. If no occupancy is detected, zone returns to auto-on. If occupancy is detected, lightsmust be turned on via the switch.

7. Multi-Level Operation (multiple lighting levels per manual button press)

• Operating mode designed specifically for bi-level applications.

• Enables the user to cycle through up to four potential on/off/dim low/dim high lighting states using only a single button.

• Eliminates user confusion as to which of two buttons controls which load

• Three different transition sequences are available in order to comply with energy codes or user preference).

• Mode available as a setting on all devices that have single manual on/off switch (ex. nPODM, nPODM-DX, nWSX LV).

• Depending on the sequence selected, every button push steps through relay/dimmingstates according to below table

• In addition to achieving bi-level lighting control by switching loads with relays, the ability to command dimming outputs to “step” in a sequence that achieves bi-level operation is present.

MLO Mode		State of load after each pushbutton press			
		1st Press	2nd Press	3rd Press	4th Press
2-State (Alternating)	Load A	On	Off	Off	-
	Load B	Off	On	Off	-
2-State (Both On, A First)	Load A	On	On	Off	-
	Load B	Off	On	Off	-
2-State (Both On, B First)	Load A	Off	On	Off	-
	Load B	On	On	Off	-
3-State	Load A	On	Off	On	Off
	Load B	Off	On	On	Off
A and B On [1]	Load A	On	Off	-	-
	Load B	On	Off	-	-
A On Only [1]	Load A	On	Off	-	-
	Load B	Off	Off	-	-
A and B On & Dim High [1]	Load A	High	Off	-	-
	Load B	High	Off	-	-
Dim Low /High	Load A	Low	High	Off	-
Dim Low / High	Load A	High	Low	Off	-

NOTE 1: Modes for use only when Auto-On state of Load A & B is different than first MLO state

W. A taskbar style desktop application shall be available for personal lighting control.
X. An application that runs on “smart” handheld devices (such as an Apple® IPhone®) shall be available for personal lighting control.
Y. Control software shall enable logging of system performance data and presenting thisl information in a web-based format and downloadable to .CSV files.
Z. Control software shall enable integration with a BMS via BACnet IP, although a hardware BACnet IP integration solution is also available.
AA. System shall provide the option of having pre-terminated plenum rated CAT-5e cabling supplied with hardware.

2.3 INDIVIDUAL DEVICE SPECIFICATIONS

A. Control module (gateway)
1. Control module shall be a device that facilitates communication and time-based control of downstream network devices and linking into an Ethernet network.
2. Devices shall have a user interface that is capable of wall mounting, powered by low voltage, and have a touch screen.
3. Control device shall have three RJ-45 ports for connection to the graphic touch screen, other backbone devices bridges) or directly to lighting control devices(up to 128 per port).
4. Device shall automatically detect all devices downstream of it.
5. Device shall have a standard and astronomical internal time clock.
6. Device shall have one RJ-45 10/100 BaseT Ethernet connection.
7. Device shall have a USB port

8. Each control gateway device shall be capable of linking 1500 devices to the management software, with reduced memory version capable of support up to 400 devices.
9. Device shall be capable of using a dedicated static or DHCP assigned IP address.
10. Network Control Gateway device shall be the following nLight model Series:
    nGWY2

B. Networked system occupancy sensors
1. Occupancy sensors shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
2. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state, thus preventing false on conditions. Ultrasonic or Microwave based sensing technologies shall not be accepted.
3. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional "dual" technology shall be used.
4. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants. Sensors where both technologies detect motion (PIR/Ultrasonic) shall not be acceptable.
5. All sensing technologies shall be acoustically passive, meaning they do not transmit sounds waves of any frequency (for example in the Ultrasonic range), as these technologies have the potential for interference with other electronic devices within the space (such as electronic white board readers). Acceptable detection technologies include Passive Infrared (PIR), and/or Microphonics technology. Ultrasonic or Microwave based sensing technologies shall not be accepted.
6. Sensors shall be available with zero or one integrated dry contact switching relays, capable of switching 1 amp at 24 VAC/VDC (resistive only).
7. Sensors shall be available with one or two occupancy "poles", each of which provides a programmable time delay.
8. Sensors shall be available in multiple lens options which are customized for specific applications.
9. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
10. All sensors shall have two RJ-45 ports or capable of utilizing a splitter.
11. All sensors shall have the ability to detect when it is not receiving valid communication (via CAT-5 connections) and blink its LED in a pattern to visually indicate of a potential wiring issue
12. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.
13. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5 cabling.
14. Sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements.
15. Wall switch sensors shall recess into single-gang switch box and fit a standard GFI opening.
16. Wall switch sensors must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections

shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.

17. Wall switch sensors shall have optional features for photocell/daylight override, and low temperature/high humidity operation.
18. Wall switch sensors shall be available in four standard colors (Ivory, White, Light Almond, Gray)
19. Wall switch sensors shall be available with optional raise/lower dimming adjustment controls.
20. Wall switch sensors shall be the following nLight model numbers, with device color and optional features as specified:
    nWSX (PIR, 1 Relay)
    nWSX PDT (Dual Tech, 1 Relay)
    nWSX LV (PIR, No Relay)
    nWSX PDT LV (Dual Tech, No Relay)
    nWSX LV NL (PIR w/ Night Light, No Relay)
    nWSX PDT LV NL (Dual Tech w/ Night Light, No Relay)
    nWSX LV DX (PIR, No Relay, Raise/Lower Dim Ctrl)
    nWSX PDT LV DX (Dual Tech, No Relay,Raise/Lower Dim Ctrl)

21. Network system shall have sensors that can be embedded into luminaire such that only the lens shows on luminaire face.
22. Embedded sensors shall be capable of both PIR and Dual Technology occupancy detection
23. Embedded sensors shall have an optional photocell
24. Embedded sensors shall be the following nLight model number:
    nES 7 (PIR, No Relay)
    nES 7 ADCX (PIR w/ Photocell, No Relay)
    nES PDT 7 (Dual Technology, No Relay)
    nES PDT 7 ADCX (Dual Technology w/ Photocell, No Relay)

25. Network system shall also have ceiling, fixture, recessed, & corner mounted sensors available.
26. Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.
27. Sensors shall be the following nLight model numbers, with device options as specified:

Model # Series	Occupancy Poles	# of Relays	Lens Type	Detection Technology
nCM(B) 9	1	-	Standard	PIR
nCM(B) 9 2P	2	-	Standard	PIR
nCM 9 RJB	1	-	Standard	PIR
nCM 9 2P RJB	2	-	Standard	PIR
nCM(B) PDT 9	1	-	Standard	Dual
nCM(B) PDT 9 2P	2	-	Standard	Dual
nCM PDT 9 RJB	1	-	Standard	Dual
nCM PDT 9 2P RJB	2	-	Standard	Dual
nCM(B) 10	1	-	Extended	PIR
nCM(B) 10 2P	2	-	Extended	PIR
nCM 10 RJB	1	-	Extended	PIR
nCM 10 2P RJB	2	-	Extended	PIR
nCM(B) PDT 10	1	-	Extended	Dual
nCM(B) PDT 10 2P	2	-	Extended	Dual
nCM PDT 10 RJB	1	-	Extended	Dual
nCM PDT 10 2P RJB	2	-	Extended	Dual
nRM 9	1	-	Standard	PIR
nRM PDT 9	1	-	Standard	Dual
nRM 10	1	-	Extended	PIR
nRM PDT 10	1	-	Extended	Dual
nRM 6	1	-	High Bay	PIR
nRM 50	1	-	Aisle Way	PIR
nWV 16	1	-	Wide View	PIR
nWV PDT 16	1	-	Wide View	Dual
nHW13	1	-	Hallway	PIR
nCM(B) 6	1	-	High Bay	PIR
nCM 6 RJB	1	-	High Bay	PIR

C. Networked system daylight (photocell and/or dimming) sensors
   1. Photocell shall provide for an on/off set-point, and a deadband to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
   2. Photocell and dimming sensor's set-point and deadband shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.

3. Deadband setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
4. Photocell and dimming sensors shall be equipped with an automatic override for100 hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the "auto set-point" setting.)
5. Combination units that have all features of on/off photocell and dimming sensors shall also be available.
6. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control Photocell, or Combination units. The second zone shall be capable of being controlled as an "offset" from the primary zone.
7. Sensor shall be the following nLight model numbers, with device options as specified:

   nCM(B) PC (RJB) (on/off)
   nCM(B) PC DZ (RJB) (on/off control, dual zone)
   nCM(B) ADCX (RJB) (remote automatic dimming control photocell)
   nCM(B) ADCX DZ (RJB) (remote automatic dimming control photocell, dual zone)
   nRM PC (on/off)
   nRM PC DZ (on/off, dual zone)
   nRM ADCX (remote automatic dimming control photocell)
   nRM ADCX DZ (remote automatic dimming control photocell, dual zone)
8. Network system shall have dimming photocells that can be embedded into luminaire such that only the lens shows on luminaire face.
9. Embedded sensors shall be the following nLight model number:
   nES ADCX (Dimming Photocell)

D. Networked System Power (Relay) Packs

1. Power Packs shall incorporate one Class 1 relay, a 0-10 VDC dimming output, and contribute low voltage power to the rest of the system. Secondary Packs shall incorporate the relay and 0-10 VDC or line voltage dimming output, but shall not be required to contribute system power. Power Supplies shall provide system power only, but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.
2. Power Packs shall accept 120 or 277 VAC (or optionally 347 VAC), be plenum rated, and provide Class 2 power to the system.
3. All devices shall have two RJ-45 ports.
4. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.
5. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple or be capable of being secured within a luminaire ballast channel. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
6. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to

pass through chase nipple into adjacent junction box without any exposure of wire leads.

7. Power Packs and Power Supplies shall be available that are WiFi enabled.
8. Power Packs (Secondary) shall be available that provide up to 16 Amp switching of all lighting load types.
9. Power Packs shall be available that provide up to 5 Amps switching of all lighting load types as well as 0-10 VDC dimming or fluorescent ballasts/LED drivers.
10. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120 VAC incandescent lighting loads or 120/277 VAC line voltage dimmable fluorescent ballasts (2-wire and 3-wire versions).
11. Specific Secondary Packs shall be available that provide up to 5 Amps of switching and can dim 120/277 VAC magnetic low voltage transformers.
12. Specific Secondary Packs shall be available that provide up to 4 Amps of switching and can dim 120 VAC electronic low voltage transformers.
13. Specific Power/Secondary Packs shall be available that are UL924 listed for switching of Emergency Power circuits.
14. Specific Secondary Packs shall be available that control louver/damper motors for skylights.
15. Specific Secondary Packs shall be available that provide a pulse on/pulse off signal for purposes of controlling shade systems via relay inputs.
16. Power (Secondary) Packs shall be available that provide up to 20 Amps switching of general purposed receptacle (plug-load) control.
17. Power (Relay) Packs and Supplies shall be the following nLight model numbers:
    nPP16 (Power Pack w/ 16A relay)
    nPP16 D (Power Pack w/ 16A relay and 0-10VDC dimming output)
    nPP16 WIFI (Power Pack w/ 16A relay, WIFI enabled)
    nEPP5 D (Power Pack w/ 5A relay and 0-10VDC dimming output)
    nSP16 (Secondary Pack w/ 16A relay)
    nPP16 ER (UL924 Listed Secondary Pack w/ 16A relay for switching emergency power circuits)
    nPP16 D ER UL924 Listed Secondary Pack w/ 16A relay and 0-10VDC dimming output for switching/dimming emergency power circuits)
    nSP5 PCD 2W (Secondary Pack w/ 5A relay and incandescent dimming or 2-wire line voltage fluorescent dimming output)
    nSP5 PCD 3W (Secondary Pack w/ 5A relay and 3-wire line voltage fluorescentdimming output)
    nSP5 PCD MLV (Secondary Pack w/ 5A relay and magnetic low voltage dimming output)
    nSP5 PCD ELV 120 (Secondary Pack w/ 4A relay and electronic low voltage dimming output)
    nSP5 2P LVR (Louver/Damper Control Pack
    nSHADE (Pulse On/Off Control Pack
    nPP20 PL (Secondary Pack w/ 20A relay for general purpose receptacle load)
    nPS 80 (Auxiliary Bus Power Supply)
    nPS 80 WIFI (Auxiliary Bus Power Supply, WiFi enabled)
    nAR 40 (Low voltage auxiliary relay pack)

E. Networked System Relay & Dimming Panels

1. Panel shall incorporate up to 4 normally closed latching relays capable of switching 120/277 VAC or up to 2 Dual Phase relays capable of switching 208/240/480 VAC loads.
2. Relays shall be rated to switch up to a 30A ballast load at 277 VAC.
3. Panel shall provide one 0-10VDC dimming output paired with each relay.
4. Panel shall power itself from an integrated 120/277 VAC supply.
5. Panel shall be capable of operating as either two networked devices or as one.
6. Panel shall supply current limited low voltage power to other networked devices connected via CAT-5.
7. Panel shall provide auxiliary low voltage device power connected wired directly to a dedicated terminal connection.
8. Power (Relay) Packs and Supplies shall be the following nLight model numbers:
   nPANEL 4 (Panel w/ four 120/277 VAC relays and four 0-10 VDC dimming outputs)
   nPANEL 2 480 (Panel w/ two dual phase relays (208/240/480 VAC) and two 0-10 VDC dimming outputs)

F. Networked Auxiliary Input / Output (I/O) Devices
1. Devices shall be plenum rated and be inline wired, screw mountable, or have an extended chase nipple for mounting to a ½" knockout.
2. Devices shall have two RJ-45 ports
3. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
4. Specific I/O devices shall have a dimming control output that can control 0-10 VDC dimmable ballasts or LED drivers by sinking up to 20 mA of current.
5. Specific I/O devices shall have an input that reads a 0-10 VDC signal from an external device.
6. Specific I/O devices shall have a switch input that can interface with either a maintained or momentary switch and run a switch event (toggle the lighting load) or run a local/remote control profile.
7. Specific I/O devices shall sense state of low voltage outdoor photocells.
8. Specific I/O devices shall enable RS-232 communication between lighting control system and Touch Screen based A/V control systems.
9. Specific I/O devices shall sense momentary and maintained contact closures, and either toggle a connected load after a momentary contact or ramp the load high/low during a maintained contact (stopping when the contact releases).
10. Auxiliary Input/Output Devices shall be the following nLight model numbers:
    nIO D (I/O device with 0-10 dimming output)
    nIO 1S or nIO RLX (I/O device with contact closure or 0-10VDC dimming input)
    nIO NLI (Input device for detecting state of low voltage outdoor photocell; sold in nIO PC KIT only)
    nIO X (Interface device for communicating with RS-232 enabled AV Touch Screens

G. Networked LED Luminaires
1. Networked LED luminaire shall have a mechanically integrated control device
2. Networked LED luminaire shall have two RJ-45 ports available (via control device directly or incorporated RJ-45 splitter)

3. Networked LED luminaire shall be able to digitally network directly to other network control devices (sensors, photocells, switches, dimmers)
4. Networked LED luminaire shall provide low voltage power to other networked control devices (excluding EMG versions)
5. System shall be able to turn on/off specific LED luminaires without using a relay, if LED driver supports “sleep mode”
6. System shall be able to maintain constant lumen output over the specified life of the LED luminaire (also called lumen compensation) by varying the input control power (and thus saving up to 20% power usage).
7. System shall indicate (via a blink warning) when the LED luminaire has reached its expected life (in hrs).
8. Integrated control devices shall be the following nLight model series:
   nIO LEDG (ER)
   nIO EZ PH (ER)
   nPS 80 EZ (ER)
   nEPS 60 IO EZ
   nEIO EZ LC (ER)
9. LED Luminaires shall be the following Acuity Brands LED fixtures, which come factory enabled with nLight devices:
   Lithonia model families:
   RTL(X)
   TL(X)
   VTL(X)
   FSL(X)
   ACL(X)
   ALL(S)
   AVL
   BZL
   GTL
   SBS
   IBL/IBH
   PTN
   LDN
   DOM
   WL
   STL

   Gotham model families:
   EVO
   Incito

   Mark model families:
   Slot 2/4/6
   Fin
   Veil
   Whisper
   Nol
   SPR

Peerless model families:
Vellum
Mino
Round 2/4
Square
Origami
Bruno
Staple
Lightline
Lightedge
Icetray
Cerra
Prima
Naro
Tulip
Envision
Aero
Enzo

H. Networked System Wall Switches & Dimmers

1. Devices shall recess into single-gang switch box and fit a standard GFI opening.
2. Communication and low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
3. All devices shall have two RJ-45 ports.
4. All devices shall provide toggle switch control. Dimming control and low temperature/high humidity operation are available options.
5. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).
6. Devices with mechanical push-buttons shall provide tactile and LED user feedback.
7. Devices with mechanical push-buttons shall be made available with custom button labeling
8. Devices with a single "on" button shall be capable of selecting all possible lighting combinations for a bi-level lighting zone such that the user confusion as to which of two buttons (as is present in multi-button scenarios) controls which load is eliminated.
9. Wall switches & dimmers shall be the following nLight model numbers, with device options as specified:
   nPODM (single on/off, push-buttons, LED user feedback)
   nPODM DX (single on/off, single dimming raise/lower, push-buttons, LED user feedback)
   nPODM 2P (dual on/off, push-buttons, LED user feedback)
   nPODM 2P DX (dual on/off, dual dimming raise/lower, push-buttons, LED user feedback)
   nPODM 4P (quad on/off, push-buttons, LED user feedback)
   nPODM 4P DX (quad on/off, quad dimming raise-lower, push-buttons, LED user feedback)

I. Networked System Graphic Wall Station

1. Device shall have a 3.5" full color touch screen for selecting up to 16 programmable lighting control preset scenes or acting as up to 16 on/off/dim control switches.
2. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).

3. Device shall enable configuration of all switches, dimmers, and lighting preset scenes via password protected setup screens.
4. Device shall enable user supplied .jpg screen saver image to be uploaded.
5. Device shall surface mount to single-gang switch box.
6. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply.
7. Device shall have a micro-USB style connector for local computer connectivity.
8. Device shall have two RJ-45 ports for communication
9. Device shall be the following nLight model number:
   nPOD GFX

J. Networked System Scene Controllers

1. Device shall have two, three, four, or eight buttons for selecting programmable lighting control profiles or acting as on/off switches.
2. Devices shall be available in four colors (Ivory, White, Light Almond, Gray).
3. Device shall recess into single-gang switch box and fit a standard GFI opening.
4. Devices shall provide LED user feedback.
5. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
6. All devices shall have two RJ-45 ports.
7. Device shall be capable of reprogramming other devices in its zone so as to implement user selected lighting scene.
8. Device shall be capable of selecting a lighting profile be run by the system's upstream Gateway so as to implement selected lighting profile across multiple zones (and not just its local zone).
9. Device shall have LEDs indicating current selection.
10. Scene Selector device shall be the following nLight model number:
    nPODM 2S (2 Scene, push-button)
    nPODM 4S (4 Scene, push-button)
    nPODM 4S DX (4 Scene, push-button, On/Off/Raise/Lower)
    nPODM 2L (2 Adjustable Preset Levels, push-button, On/Off)
    nPODM 2L AB (2 Scene, push-button, On/Off/High/Low)
    nPODM 4L DX (4 Adjustable Preset Levels, push-button, On/Off/Raise/Lower)

K. Communication Bridges

1. Device shall surface mount to a standard 4" x 4" square junction box.
2. Device shall have 8 RJ-45 ports.
3. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to Control Gateway.
4. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply or delivered via a CAT-5 cabled connection.
5. Device shall be capable of redistributing power from its local supply and connect lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.
6. Communication Bridge devices shall be the following nLight model numbers:

nBRG 8 (8 Ports)

2.4. LIGHTING CONTROL PROFILES

A. Changes to the operation of the system shall be capable of being made in real-time or scheduled via lighting control profiles. These profiles are outlines of settings that direct how a collection of devices function for a defined time period.
B. Lighting control profiles shall be capable of being created and applied to a single device, zone of devices, or customized group of zones.
C. All relays and dimming outputs shall be capable of being scheduled to track or ignore information regarding occupancy, daylight, and local user switches via lighting control profiles.
D. Specific device parameters (e.g. sensor time delay and photocell set-point) shall be configurable via a lighting control profile.
E. All lighting control profiles shall be stored on the network control gateway device, with a system backup on the software's host server.
F. Lighting control profiles shall be capable of being scheduled to run according to the following calendar options: start date/hour/minute, end date/hour/minute, and sunrise/sunset +/- timed offsets.
G. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.
H. Daylight savings time adjustments shall be capable of being performed automatically, if desired.
I. Lighting control profile schedules shall be capable of being given the following recurrence settings: daily, weekday, weekend, weekly, monthly, and yearly.
J. Software shall provide a graphical tool for easily viewing scheduled lighting control profiles.

2.5. MANAGEMENT SOFTWARE

A. Every device parameter (e.g. sensor time delay and photocell set-point) shall be available and configurable remotely from the software
B. The following status monitoring information shall be made available from the software for all devices for which it is applicable: current occupancy status, current PIR Status, current Microphonics Status, remaining occupancy time delay(s), current photocell reading, current photocell inhibiting state, photocell transitions time remaining, current dim level, device temperature, and device relay state(s).
C. The following device identification information shall be made available from the software: model number, model description, serial number, manufacturing date code, custom label(s), and parent network device.
D. A printable network inventory report shall be available via the software.
E. A printable report detailing all system profiles shall be available via the software.
F. Software shall require all users to login with a User Name and Password.
G. Software shall provide at least three permission levels for users.
H. All sensitive stored information and privileged communication by the software shall be encrypted.
I. All device firmware and system software updates must be available for automatic download and installation via the internet.
J. Software shall be capable of managing systems interconnected via a WAN (wide area network)

2.6. BMS COMPATIBILITY

A. System shall provide a BACnet IP gateway as a downloadable software plug-in to its management software.
B. BACnet IP connection shall also be available utilizing JACE-600 hardware unit.

C. BACnet IP hardware shall be capable of supporting up to 1500 total devices across up to 5 total Gateways
D. BACnet IP connection shall communicate information gathered by networked system to other building management systems.
E. BACnet IP connection shall translate and forward lighting relay and other select control commands from BMS system to networked control devices via profiles stored in the system Gateway. All system devices shall be available for polling for devices status.
F. BACnet IP hardware device shall be the following nLight model name:
nBACnet

2.7. SYSTEM ENERGY ANALYSIS & REPORTING SOFTWARE

A. System shall be capable of reporting lighting system events and performance data back to the management software for display and analysis.
B. Intuitive graphical screens shall be displayed in order to facilitate simple viewing of system energy performance.
C. An “Energy Scorecard” shall be display that shows calculated energy savings in dollars, KWHr, or CO2.
D. Software shall calculate the allocation of energy savings to different control measures (occupancy sensors, photocells, manual switching, etc).
E. Energy savings data shall be calculated for the system as a whole or for individual zones.
F. A time scaled graph showing all relay transitions shall be presented.
G. A time scaled graph showing a zones occupancy time delay shall be presented
H. A time scaled graph showing the total light level shall be presented.
I. User shall be able to customize the baseline run-time hours for a space.
J. User shall be able to customize up to four time-of-day billing rates and schedules.
K. Data shall be made available via a .CSV file

2.8. START-UP & SUPPORT FEATURES

A. Pre-construction Jobsite Visit
a. Project electrical contractor/distributor shall contact Spectrum Lighting – San Antonio to schedule jobsite meeting prior to the beginning of the installation of the lighting control system. Purpose of the meeting is to review installation documentation provided by the system manufacturer and submittals. Discussion should include wiring conventions and specific wiring requirements. Installation of specific devices are also to be addressed.
b. Purpose is to review any questions regarding the installation of the lighting control system by the installing contractor.
c. Prior to commissioning Spectrum Lighting field service technical shall visit the jobsite to confirm progress and answer any additional questions. Commissioning date is to be confirmed at the time of this visit. Training agenda shall be provided to the contractor/distributor. Contractor/distributor shall confirm owner representative and specifying engineer attendance at lighting system demonstration and/or for training. Contractor/distributor shall provide to filed service technician programming information as required for commissioning to include zone assignments, time schedules for operation, presets for all control stations, programming sequences for dynamic LED fixtures, emergency operation, blink warn, and system override. Programming information is required for system set-up and pre-commissioning.

B. Lighting Control System Commissioning and Training
   a. Prior to energizing the lighting control system, the following must be completed: No component of the lighting control system shall be energized prior to a factory certified field service engineer has approved the installation of the system by the project electrical contractor. Failure to have a factory certified field service technician approve the installation and commission the system will relieve the manufacturer of the lighting control equipment of all responsibility relating to damaged parts or warranty. The electrical contractor/distributor shall contact Spectrum Lighting at least 3 weeks prior to the requested commissioning date to schedule a field service engineer to be at the jobsite. Request shall be in writing and shall include filled out commissioning request form and dated jobsite photos of the dimmer and/or relay panels.
   b. Lighting Control system is defined as the dimmer/relay panel(s) and all associated control stations and related accessories.
   c. The electrical contractor is responsible to install the entire lighting control system, all power feeders, all load wiring, and control wiring. Equipment shall be installed according to the manufacturer's instructions, contract documents, and national and local codes and regulations.
   d. Equipment shall be plumb and level to the finished floor. All components of the lighting control system shall be clean, free of dust and paint spatters. Components shall be unmarred or damaged. All cable shall be dressed, neatly routed, and labeled. All conduit shall be securely attached to the dimmer/relay panel.

C. Commissioning
   a. Each dimmer/relay panels shall be individually tested with the connected load as designed. Each dimmer/relay should be tested with its connected load as specified.
   b. Each dimmer/relay shall be tested by the electrical contractor (with a multi-meter) to confirm what voltage is being passed and to confirm that no voltage is being passed when the circuit is open.
   c. A representative of the owner shall be present to observe the testing/demonstration of the dimmer/relay panels. Each individual dimmer/relay panel shall be load tested with all circuits on while under load for a minimum of 1 hour.
   d. Where external devices are to be attached to the dimmer/relay panel including photocell, occupancy sensor, time clock, and/or control stations, operation of each device should be verified at the panel and specific circuits that are programmed to be controlled by the external device(s).
   e. Where control signals originate from the dimmer/relay panel for control of lighting fixtures, the control signal shall be tested by the electrical contractor to confirm that it is being delivered to each lighting fixture. Proper operation of the lighting fixtures shall be confirmed as part of the system testing/demonstration.

D. Training
   a. Training shall be provided for the owner's representative and contractor FOR A TOTAL OF 8-HOURS. Prior to commissioning owner's representative and electrical contractor/distributor shall acknowledge receipt of training agenda. Electrical contractor/distributor shall confirm that specifying engineer has been contacted and been invited to attend the system demonstration and/or training. All product and lighting control system documentation and operation's manuals shall be provided by electrical contractor/distributor at the time of training.
   b. Training is to include, but not be limited to: basic operation of lighting control system, set-up of system and control panels, operation of control stations, programming of system, basic be-bugging, and overall system testing. At completion of training session all in attendance shall

sign the commissioning technician's field service report to confirm participation in the training session.

c. Completed field service report shall be submitted to the electrical contractor/distributor and specifying engineer.

E. Follow-up Contact

a. Approximately 90 days following the commissioning of the lighting control system Spectrum Lighting shall contact the electrical contractor/distributor to confirm that the system is operating correctly and answer any operational questions that have come-up since commissioning.

F. Warranty Review and Follow-up Visit

a. Approximately 300 days following commissioning of the lighting control system Spectrum Lighting shall contact the owner's representative who attended the system demonstration and training and electrical contractor/distributor to schedule a visit to the jobsite. Visit shall be scheduled so that testing of the lighting control system and related equipment can be conducted without disturbing normal operation of the jobsite. In attendance should be owner's representative and contractor.

b. The lighting control system shall be demonstrated to confirm operation. All system programming shall be confirmed and when necessary adjusted to meet the set-up or current requirements. When programming needs to be adjusted the new system configuration files shall be forwarded by the field service technician to the system manufacturer, as required. Copies can be provided to owner's representative upon request. Any questions regarding operation of the system shall be addressed at this time.

c. Any lighting control equipment that is not operating as defined by the specification shall be repaired or replaced at the discretion of the field service technician. Projected dates for completion of all changes will be included in the follow-up report. All system changes and updates shall be documented by the field service technician and provided in a written report to the owner's representative, contractor, and specifying engineer.

d. To facilitate start-up, all devices daisy-chained together (using CAT-5) shall automatically be grouped together into a functional lighting control zone.

e. All lighting control zones shall be able to function according to default settings once adequate power is applied and before any system software is installed.

f. Once software is installed, system shall be able to auto-discover all system devices without requiring any further programming.

g. All system devices shall be capable of being given user defined names.

h. All devices within the network shall be able to have their firmware upgraded remotely and without being physically uninstalled for purposes of upgrading functionality at a later date.

i. All sensor devices shall have the ability to detect improper communication wiring and blink it's LED in a specific cadence as to alert installation/startup personnel.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:

1. Edit panelboards below to suit Project.
2. Lighting and appliance branch-circuit panelboards.
3. Distribution panelboards.

B. Related Sections include the following:

1. List below only products, construction, and equipment that the reader might expect to find in this Section but are specified elsewhere.
2. Retain subparagraph below if Project includes fusible panelboards.
3. Section "Fuses."

1.3 DEFINITIONS

A. Retain abbreviations that remain after this Section has been edited.

B. EMI: Electromagnetic interference.

C. GFCI: Ground-fault circuit interrupter.

D. RFI: Radio-frequency interference.

E. RMS: Root mean square.

F. SPDT: Single pole, double throw.

G. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, TVSS device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
   a. Enclosure types and details for types other than NEMA 250, Type 1.
   b. Bus configuration, current, and voltage ratings.
   c. Short-circuit current rating of panelboards and overcurrent protective devices.
   d. Delete subparagraph below if series rating of overcurrent protective devices is not used.
   e. UL listing for series rating of installed devices.

f. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

C. Delete paragraph below if independent testing agency is not used.

D. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.

E. Field Test Reports: Submit written test reports and include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

F. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

G. Maintenance Data: For panelboards and components to include in maintenance manuals specified in other sections. In addition to requirements specified in Section "Contract Closeout," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Retain paragraph and subparagraph below if Contractor or manufacturer selects testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

1.6 COORDINATION

A. Edit below to delete or add types of equipment that affect panelboard installation.

B. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.7 EXTRA MATERIALS

A. Extra materials may not be allowed for publicly funded projects. Revise quantity below to suit Project.

B. Keys: [SIX] 6 spares of each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Retain above for nonproprietary or below for semiproprietary Specification. Refer to Division 1 Section "Materials and Equipment."

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Lists below are examples only. Retain or insert only those manufacturers whose products correspond with other requirements and whose availability and suitability for the application have been verified.
2. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
   a. Eaton
   b. Square D Co.
   c. General Electric
   d. Siemens

2.2 FABRICATION AND FEATURES

A. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1, to meet environmental conditions at installed location.
   1. Outdoor Locations: NEMA 250, Type 3R.
   2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
   3. Enclosures in hazardous locations must be carefully selected to meet the division and group listing of the environment.
   4. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

B. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

C. Retain paragraph above or below.

D. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

E. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.

F. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.

G. Bus: Hard-drawn copper, 98 percent conductivity.

H. Main and Neutral Lugs: Copper mechanical type suitable for use with conductor material.

I. Ten paragraphs below are special features. Add other required features and coordinate with Drawings.

J. Equipment Ground Bus: Copper and adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

K. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

L. Isolated Equipment Ground Bus: Copper and adequate for branch-circuit equipment ground conductors; insulated from box.

M. Extra-Capacity Neutral Bus: Copper neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.

N. Split Bus: Vertical buses divided into individual vertical sections.

O. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.

P. Gutter Barrier: Arrange to isolate individual panel sections.

Q. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

R. Feed-through Lugs: Copper mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Plug-in or bolt on circuit breakers, replaceable without disturbing adjacent units.

B. Coordinate below with Drawings.

C. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.5 DISTRIBUTION PANELBOARDS

A. Edit three paragraphs and associated subparagraphs below to suit Project. Coordinate with Drawings.

B. Doors: Front mounted, except omit in fused-switch panelboards; secured with vault-type latch with tumbler lock; keyed alike.

C. Main Overcurrent Protective Devices: Circuit breaker.

D. Branch overcurrent protective devices shall be one of the following:
   1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in or Bolt-on circuit breakers.

2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.6 OVERCURRENT PROTECTIVE DEVICES

A. Edit three paragraphs and associated subparagraphs below to suit Project. Coordinate with schedules and Drawings.

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and I^2t response.
3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
4. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
5. GFCI Circuit Breakers: Single- and two-pole configurations with [5] [30]-mA trip sensitivity.

C. Molded-Case Circuit-Breaker Features and Accessories. Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and material of conductors.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mounting Heights: Top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.

C. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

D. Revise paragraph below if "Balancing Loads" Paragraph is deleted from "Field Quality Control" Article below.

E. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

F. Install filler plates in unused spaces.

G. Revise below if "Balancing Loads" Paragraph is deleted from "Field Quality Control" Article below.

H. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

3.2 IDENTIFICATION

A. Select Division 16 Section "Basic Electrical Materials and Methods" for projects with simple requirements and Division 16 Section "Electrical Identification" for projects with complex requirements.

B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section "Basic Electrical Materials and Methods] [Electrical Identification."

C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

A. Coordinate paragraphs below with Drawings.

B. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Balancing Loads: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data-processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.5 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.6 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes receptacles, connectors, switches, and finish plates.

1.3 DEFINITIONS

A. Retain abbreviations that remain after this Section has been edited for Project.

B. GFI: Ground-fault circuit interrupter.

C. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

A. Product Data: For each product specified.

B. Shop Drawings: Legends for receptacles and switch plates.

C. Include sample review below if products may have critical features needing hands-on appraisal.

D. Samples: For devices and device plates for color selection and evaluation of technical features.

E. Maintenance Data: For materials and products to include in maintenance manuals specified in other sections.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

B. Comply with NEMA WD 1.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

B. Coordinate with pool contractor for special receptacles.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wiring Devices:
   a. Bryant Electric, Inc.
   b. Eagle Electric Manufacturing Co., Inc.
   c. GE Company; GE Wiring Devices.
   d. Hubbell, Inc.; Wiring Devices Div.
   e. Killark Electric Manufacturing Co.
   f. Leviton Manufacturing Co., Inc.
   g. Pass & Seymour/Legrand; Wiring Devices Div.
   h. Pyle-National, Inc.; an Amphenol Co.

2.2 RECEPTACLES

A. Straight-Blade and Locking Receptacles: Heavy-Duty grade. The device shall be 20-ampere, 125-volts, Nema configuration 5-20R, back and side wired.

B. Special Receptacles for NEMA configuration refer to Manufacturer specs.

C. Termination-type GFCI unit may be substituted for feed-through type where no protection of downstream receptacles is required.

D. GFI Receptacles: Feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle arranged to protect connected downstream receptacles on same circuit. Design units for installation in a 2-3/4-inch- (70-mm-) deep outlet box without an adapter. Device shall have an indicator light.

E. Isolated-Ground Receptacles: Equipment grounding contacts connected only to the green grounding screw terminal of the device with inherent electrical isolation from mounting strap. Device shall be white finish with the orange symbol.

2. Devices: Listed and labeled as solated-ground receptacles.

3. Isolation Method: Integral to receptacle construction and not dependent on removable parts.

2.3 SWITCHES

A. General

1. Switches shall be toggle rocker type as indicated herein.. The body of the switch shall be made of an arc-resistant thermoset material. All toggle switch handles shall be constructed of a thermoplastic material. All rocker switch handles shall be constructed of a thermoset material. All wall switches shall be of the quiet AC type.

2. Switches shall be SPST, DPST, 3-way or 4-way as indicated on the Drawings.

3. Switch color shall be white unless noted otherwise. Coordinate with Architect.

B. Specification Grade

1. Specification Grade switches shall be toggle type. The contact arms shall be made of one-piece copper alloy material. The switch shall include a green ground screw attached to the mounting strap. The switch shall be 20-ampere, 120/277-volts AC, horsepower rated, back and side-wired.

C. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible and electromagnetic noise filters.

2. Control: Continuously adjustable slide, toggle, or rotary knob. Single-pole or three-way switch to suit connections.

3. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz with continuously adjustable slide with “on/off” switch; single pole with soft tap or other quiet switch; electromagnetic filter to eliminate noise, RF, and TV interference; and 5-inch (130-mm) wire connecting leads. Dimmer to be sized per circuit load.

2.4 WALL PLATES(All wall plates)

A. For all single and combination types match corresponding wiring devices.

4. Plate-Securing Screws: Metal with head color to match plate finish.

5. Material for Finished Spaces: 0.04-inch- (1-mm-) thick, Type 302, satin-finished stainless steel.

6. Material for Unfinished Spaces: stainless steel.

2.5 FLOOR SERVICE FITTINGS

A. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.

B. Signal Outlet: Blank cover with bushed cable opening, unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies plumb and secure.

B. Install wall plates when painting is complete.

C. Install wall dimmers to achieve indicated rating after derating for ganging as instructed by manufacturer.

D. Do not share neutral conductor on load side of dimmers.

E. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

F. Protect devices and assemblies during painting.

G. Adjust locations at which floor service outlets and telephone/power service poles are installed to suit arrangement of partitions and furnishings.

H.

3.2 IDENTIFICATION

A. Comply with Section "Electrical Identification."

B. Comply with Section "Basic Electrical Materials and Methods."

1. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.

2. Receptacles: Identify panelboard and circuit number from which served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of plate and durable wire markers or tags within outlet boxes.

3.3 CONNECTIONS

A. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.

B. Isolated-Ground Receptacles: Connect to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.

C. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.

B. Dparagraph below if GFCIs are not in Part 2.

C. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

D. Replace damaged or defective components.

3.5 CLEANING

A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Fuses.

1.3 SUBMITTALS

A. Use this Article to convey basic design intent. Delete if Drawings show sufficient detail to clarify intent.

B. General: Submit each item in this Article according to the Conditions of the Contract and Specification Sections.

C. Product Data for each fuse type specified.

D. Select above or below. Data listed in paragraph below are appropriate where selective coordination is necessary.

E. Field test reports indicating and interpreting test results.

F. Maintenance data for tripping devices to include in the operation and maintenance manual specified in other sections.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses from one source and by a single manufacturer.

B. Comply with NFPA 70 for components and installation.

C. Listing and Labeling: Provide fuses specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
2. Subparagraph below is required by some Federal agencies.
3. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.5 EXTRA MATERIALS

A. Extra materials may not be allowed for publicly funded projects.

B. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Spare Fuses: Furnish quantity equal to 20 percent of each fuse type and size installed, but not less than 1 set of 3 of each type and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering fuses that may be incorporated into the Work include, but are not limited to, the following:

B. Retain above for nonproprietary or below for semiproprietary Specification. Refer to Division 1 Section "Materials and Equipment."

C. Manufacturers: Subject to compliance with requirements, provide fuses by one of the following:

1. See Editing Instruction No. 1 in the Evaluations for cautions about naming products and manufacturers.
2. Cooper Industries, Inc.; Bussmann Div.
3. Eagle Electric Mfg. Co., Inc.
4. Ferraz Corp.
5. General Electric Co.; Wiring Devices Div.
6. Gould Shawmut.
7. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class as specified or indicated; current rating as indicated; voltage rating consistent with circuit voltage.

2.3 SPARE FUSE CABINET

A. Cabinet: Wall-mounted, 0.05-inch- (1.27-mm-) thick steel unit with full-length, recessed piano-hinged door with key-coded cam lock and pull.

1. Size: Adequate for orderly storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: Stencil legend "SPARE FUSES" in 1-1/2-inch (40-mm) letters on door.
4. Fuse Pullers: For each size fuse.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions to verify proper fuse locations, sizes, and characteristics.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Select and edit paragraphs below. Add paragraphs as Project requires to specify fuse applications rather than show them on Drawings.

B. Motor Branch Circuits: Class RK1, time delay.

C. Other Branch Circuits: Class RK5, non-time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices as indicated. Arrange fuses so fuse ratings are readable without removing fuse.

B. Install spare fuse cabinet where indicated.

3.4 IDENTIFICATION

A. Install typewritten labels on inside door of each fused switch to indicate fuse replacement information.

END OF SECTION

SECTION 26 28 16.16

ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions and Specification sections, apply to work covered by this Section.

1.2 SCOPE OF WORK

A. Provide labor, materials, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of disconnect switches, including all related systems and accessories.

1.3 SUBMITTALS

A. Submit product data and shop drawings in accordance with other Sections for products specified under PART 2 - PRODUCTS.

B. Provide outline drawings with dimensions, and equipment ratings for voltage, amperage, horsepower and short circuit.

C. Provide designations for each disconnect. RE: to section 16075.

1.4 REFERENCE STANDARDS

A. Switches shall be manufactured in accordance with the following standards:

1. UL 98 - Enclosed and Dead Front Switches
2. NEMA KS1 - Enclosed Switches
3. NEMA 250 - Enclosures for Electrical Equipment

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Eaton

B. Square D Co.

C. General Electric

D. Siemens

2.2 GENERAL

A. Switches shall be heavy duty type.

2.3 SWITCH INTERIOR

A. Switches shall have switch blades which are visible when the switch is OFF and the cover is open.

D. Lugs shall be copper and front removable and UL listed for 60°C or 75°C conductors 30-100 ampere, 75°C conductors 200 ampere and up.

E. Current carrying parts shall be plated to resist corrosion.

F. Switches shall have removable arc suppressor to facilitate easy access to line side lugs.

G. Switches shall have provisions for a field installable electrical interlock.

2.4 SWITCH MECHANISM

A. Switch operating mechanism shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started.

B. The operating handle shall be an integral part of the box, not the cover.

C. Provisions for padlocking the switch in the OFF position with at least three padlocks shall be provided.

D. The handle position shall travel at least 90° between OFF and ON positions to clearly distinguish and indicate handle position.

E. Switches shall have a dual cover interlock mechanism to prevent unintentional opening of the switch cover when the switch is ON and prevent turning the switch ON when the cover is open. The cover interlock mechanism shall have an externally operated override but the override shall not permanently disable the interlock mechanism. The tool

used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

2.5 SWITCH ENCLOSURES

A. Switch covers shall be attached with welded pin-type hinges (Type 1) or top-hinged, attached with removable screws and securable in the open position (Type 3R).

B. The enclosure shall be finished with gray baked enamel paint which is electrodeposited on cleaned, phosphate pre-treated steel (Type 1) or gray baked enamel paint which is electrodeposited on cleaned, phosphate pre-treated galvannealed steel (Type 3R).

C. The enclosure shall have ON and OFF markings stamped into the cover.

D. The operating handle shall be provided with a dual colored, red/black position indication.

E. Switches shall have provisions to accept up to three 3/8" hasp padlocks to lock the operating handle in the OFF position.

H. Tangential knockouts shall be provided to facilitate ease of conduit entry (Type 1).

I. Type 3R enclosure shall contain no knockouts. Supply watertight hubs.

J. Type 4x shall be stainless steel enclosure with no knockouts. Supply watertight hubs.

2.6 SWITCH RATINGS

A. Switches shall be horsepower rated.

B. The UL listed short circuit current rating of the switches shall be: 200,000 rms symmetrical amperes when used with or protected by Class R or Class J fuses 30-600 ampere employing appropriate fuse rejection schemes.

PART 3- EXECUTION

3.1 INSTALLATION

E. Install disconnect switches where indicated shown or not shown.

F. Install fuses in fusible disconnect switches.

END OF SECTION

SECTION 26 32 13

STANDBY GENERATOR

PART 1- GENERAL

1.1 References and Standards

The generator set covered by these specifications shall be designed, tested, rated, assembled and installed in strict accordance with all applicable standards below:

- CSA C22.2 No14
- CSA 282
- CSA 100
- EN61000-6
- EN55011
- FCC Part 15 Subpart B
- ISO8528
- IEC61000
- UL508
- UL2200
- UL142
- Designed to allow for installed compliance to NFPA 37, NFPA 70, NFPA 99 and NFPA 110

1.2 RELATED SECTIONS

1.3 WORK INCLUDED

A. Installation

The work includes supplying and installing a complete integrated generator system. The system consists of a diesel generator set with related component accessories and automatic transfer switches specified under a separate section.

B. Fuel System

1. The CONTRACTOR shall provide a full tank of diesel fuel for the completion of all testing.

C. System Test

A complete system load test shall be performed after all equipment is installed. Guidelines in the Start-up Section.

D. Requirements, Codes and Regulations

The equipment supplied and installed shall meet the requirements of the NEC and all applicable local codes and regulations. All equipment shall be of new and current production by a MANUFACTURER who has 25 years of experience building this type of equipment. Manufacturer shall be ISO9001 certified.

1.4 SUBSTITUTION

Proposed deviations from the specifications shall be treated as follows:

A. Substitution Time Requirement

Requests for substitutions shall be made a minimum of ten (10) days prior to bid date. Manufacturers catalog data shall accompany each request and authorized acceptance shall be addenda only.

B. Substitution Responsibility

The power system has been designed to the specified manufacturer's electrical and physical characteristics. The equipment sizing, spacing, amounts, electrical wiring, ventilation equipment, fuel, and exhaust components have all been sized and designed around CATERPILLER for base bid. Should any substitutions be made, the CONTRACTOR shall bear responsibility for the installation, coordination and operation of the system as well as any engineering and redesign costs, which may result from such substitutions.

1.5 SUBMITTALS

Engine-generator submittals shall include the following information:

A. Factory published specification sheet.

B. Manufacturer's catalog cut sheets of all auxiliary components such as battery charger, control panel, enclosure, etc.

C. Dimensional elevation and layout drawings of the generator set, enclosure and transfer switchgear and related accessories.

D. Weights of all equipment.

E. Concrete pad recommendation, layout and stub-up locations of electrical and fuel systems.

F. Interconnect wiring diagram of complete emergency system, including generator, switchgear, day tank, remote pumps, battery charger, control panel, and remote alarm indications.

G. Engine mechanical data, including heat rejection, exhaust gas flows, combustion air and ventilation air flows, fuel consumption, etc.

H. Generator electrical data including temperature and insulation data, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.

I. Generator resistances, reactances and time constants.

J. Generator locked rotor motor starting curves.

K. Manufacturer's documentation showing maximum expected transient voltage and frequency dips, and recovery time during operation of the generator set at the specified site conditions with the specified loads.

L. Manufacturer's and dealer's written warranty.

1.7 SYSTEM RESPONSIBILITY

A. Generator Set Distributor

The completed engine generator set shall be supplied by the Manufacturer's authorized distributor only.

B. Requirements, Codes and Regulations

The equipment supplied and installed shall meet the requirements of NEC and all-applicable local codes and regulations. All equipment shall be new, of current production. There shall be one source responsibility for warranty; parts and service through a local representative with factory trained service personnel.

C. Automatic Transfer Switch

The automatic transfer switch(es) specified in another section shall be supplied by the generator set manufacturer in order to establish and maintain a single source of system responsibility and coordination.

1.8 WARRANTY

A. Two Year Standby (ISO 8528-1: ESP) Generator Set Warranty

The manufacturer's standard warranty shall in no event be for a period of less than two (2) years from date of initial start-up of the system and shall include repair parts, labor, reasonable travel expense necessary for repairs at the job site, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of repair. Running hours shall be limited to 500 hours annually for the system warranty by both the manufacturer and servicing distributor. Submittals received without written warranties as specified will be rejected in their entirety.

1.9 PARTS AND SERVICE QUALIFICATIONS

A. Service Facility

The engine-generator supplier shall maintain 24-hour parts and service capability within 100 miles of the project site. The distributor shall stock parts as needed to support the generator set package for this specific project. The supplier must carry sufficient inventory to cover no less than 80% parts service within 24hrs and 95% within 48 hours.

B. Service Personnel

The dealer shall maintain qualified factory trained service personnel.

PART 2- PRODUCT SPECIFICATIONS

2.1 GENERAL REQUIREMENTS

A. Generator set Requirements

The generator set shall be Standby Duty refer to drawings for KW rating,
N/A RPM, 0.8 power factor, 208 V, 3-Phase,
60 hertz, including radiator fan and all parasitic loads. Generator set shall be sized to operate at the specified load at a maximum ambient of 122F (50.0C) and altitude of
500.0 feet (152.4 m).
Standby Power Rating:
Power is available for the duration of an emergency outage
Average Power Output = 70% of standby power
Load = Varying
Typical Hours/Year = 200 Hours
Maximum Expected Usage = 500 hours/year
Typical Application = Standby

A. Material and Parts

a. All materials and parts comprising the unit shall be new and unused.

B. Engine

a. The engine shall be diesel fueled, four (4) cycle, turbocharged, charge air cooled, while operating with nominal speed not exceeding 1800 RPM. The engine will utilize in-cylinder combustion technology, as required, to meet applicable EPA non-road mobile regulations and/or the EPA NSPS rule for stationary reciprocating compression ignition engines. Additionally, the engine shall comply with the State Emission regulations at the time of installation/commissioning. Actual engine emissions values must be in compliance with applicable EPA emissions standards per ISO 8178 – D2 Emissions Cycle at specified ekW / bHP rating. Emissions requirements / certifications of this package:
    1. EPA T3

C. Engine Governing

a. The engine will be equipped with an isochronous electronic governor to maintain +/- 6 RPM steady state frequency variation from steady state no load to steady state full load.

2.2 GENERATOR

A. Generator Specifications

The synchronous generator shall be a single bearing, self-ventilated, drip-proof design in accordance with NEMA MG 1 and directly connected to the engine flywheel housing with a flex coupling. The generator shall meet performance class G2 of ISO 8528. The excitation system shall be of brushless construction.

B. Voltage Regulator

C. Automatic Voltage Regulator

The automatic voltage regulator (AVR) shall maintain generator output voltage within +/- 0.5% for any constant load between no load and full load. The regulator shall be a totally solid state design, which includes electronic voltage buildup, volts per Hertz regulation, over-excitation protection, shall limit voltage overshoot on startup, and shall be environmentally sealed.

D. Integrated Voltage Regulator (IVR)

The IVR shall maintain generator output voltage within +/- 0.25% for any constant load between no load and full load. The regulator shall be capable of sensing true RMS in three phases of alternator output voltage, or operating in single phase sensing mode. The IVR shall be cable of configuring knee frequency and voltage regulation configurable up to +/-30% .The voltage regulator shall include a VAR/Pf control feature as standard. The regulator shall provide an adjustable dual slope regulation characteristic in order to optimize voltage and frequency response for site conditions. The IVR shall be capable of setpoint adjustment.

E. Motor Starting

Provide locked rotor motor starting capability of sKW at 20% instantaneous voltage dip as defined per NEMA MG 1. Sustained voltage dip data is not acceptable.

2.3 CIRCUIT BREAKER

A. Circuit Breaker Specifications

Provide a generator mounted 100% solid state
circuit breaker, molded case, refer to drawings for size of breakers., 3 pole, NEMA 1/IP22. Breaker shall utilize a solid state trip unit. The breaker shall be UL/CSA Listed and connected to engine/generator safety shutdowns. Breaker shall be housed in an extension terminal box which is isolated from vibrations induced by the generator set. Mechanical type lugs, sized for the circuit breaker feeders shown on drawing, shall be supplied on the load side of breaker.

2.4 CONTROLS – GENERATOR SET MOUNTED (EMCP 4.2)

Provide a fully solid-state, microprocessor based, generator set control. The control panel shall be designed and built by the engine manufacturer. The control shall provide all operating, monitoring, and control functions for the generator set. The control panel shall provide real time digital communications to all engine and regulator controls via SAE J1939.

A. Environmental

The generator set control shall be tested and certified to the following environmental conditions:

A. –40°C to +70°C Operating Range
B. 100% condensing humidity, 30°C to 60°C
C. IP22 protection for rear of controller; IP55 when installed in control panel
D. 5% salt spray, 48 hours, +38°C, 36.8V system voltage
E. Sinusoidal vibration 4.3G's RMS, 24-1000Hz
F. Electromagnetic Capability (89/336/EEC, 91/368/EEC, 93/44/EEC, 93/68/EEC, BS EN 50081-2, 50082-2)
G. Shock: withstand 15G

B. Functional Requirements

The following functionality shall be integral to the control panel.

A. The control shall include a minimum 33 x 132 pixel, 24mm x 95mm, positive image, transflective LCD display with text based alarm/event descriptions.
B. The control shall include a minimum of 3-line data display
C. Audible horn for alarm and shutdown with horn silence switch
D. Standard ISO labeling
E. Multiple language capability
F. Remote start/stop control
G. Local run/off/auto control integral to system microprocessor
H. Cooldown timer
I. Speed adjust
J. Lamp test
K. Emergency stop push button
L. Voltage adjust
M. Voltage regulator V/Hz slope - adjustable
N. Password protected system programming

C. Digital Monitoring Capability

The controls shall provide the following digital readouts for the engine and generator. All readings shall be indicated in either metric or English units.

1. Engine

A. Engine oil pressure
B. Engine oil temperature
C. Engine coolant temperature
D. Engine RPM
E. Battery volts
F. Engine hours
G. Engine crank attempt counter
H. Engine successful start counter
I. Service maintenance interval
J. Real time clock
K. Engine exhaust stack temperature
L. Engine main bearing temperature

2. Generator

A. Generator AC volts (Line to Line, Line to Neutral and Average)
B. Generator AC current (Avg and Per Phase)
C. Generator AC Frequency
D. Generator kW (Total and Per Phase)
E. Generator kVA (Total and Per Phase)
F. Generator kVAR (Total and Per Phase)
G. Power Factor (Avg and Per Phase)
H. Total kW-hr
I. Total kVAR-hr

J. % kW
K. % kVA
L. % kVAR
M. Generator bearing temperature
N. Generator stator winding temperature

3. Voltage Regulation

A. Excitation voltage
B. Excitation current

D. Alarms and Shutdowns

The control shall monitor and provide alarm indication and subsequent shutdown for the following conditions. All alarms and shutdowns are accompanied by a time, date, and engine hour stamp that are stored by the control panel for first and last occurrence:

1. Engine Alarm/Shutdown

A. Low oil pressure alarm/shutdown
B. High coolant temperature alarm/shutdown
C. Loss of coolant shutdown
D. Overspeed shutdown
E. Overcrank shutdown
F. Emergency stop shutdown
G. Low coolant temperature alarm
H. Low battery voltage alarm
I. High battery voltage alarm
J. Control switch not in auto position alarm
K. Battery charger failure alarm

2. Generator Alarm/Shutdown

A. Generator phase sequence
B. Generator over voltage
C. Generator under voltage
D. Generator over frequency
E. Generator under frequency
F. Generator reverse power (real and reactive)
G. Generator overcurrent

3. Voltage Regulator Alarm/Shutdown

A. Loss of excitation alarm/shutdown
B. Instantaneous over excitation alarm/shutdown
C. Time over excitation alarm/shutdown
D. Rotating diode failure
E. Loss of sensing
F. Loss of PMG

E. Inputs and Outputs

1. Programmable Digital Inputs

The Controller shall include the ability to accept programmable digital input signals. The signals may be programmed for either high or low activation using programmable Normally Open or Normally Closed contacts.

2. Programmable Relay Outputs

The control shall include the ability to operate programmable relay output signals, integral to the controller. The output relays shall be rated for 2A @ 30VDC and consist of six (6) Form A (Normally Open) contacts and two (2) Form C (Normally Open & Normally Closed) contacts.

3. Programmable Discrete Outputs

The control shall include the ability to operate two (2) discrete outputs, integral to the controller, which are capable of sinking up to 300mA.

F. Maintenance

All engine, voltage regulator, control panel and accessory units shall be accessible through a single electronic service tool. The following maintenance functionality shall be integral to the generator set control

A. Engine running hours display
B. Service maintenance interval (running hours or calendar days)
C. Engine crank attempt counter
D. Engine successful starts counter
E. 40 events are stored in control panel memory
F. Programmable cycle timer that starts and runs the generator for a predetermined time. The timer shall use 7 user-programmable sequences that are repeated in a 7-day cycle. Each sequence shall have the following programmable set points:

1. Day of week
2. Time of day to start
3. Duration of cycle

G. Remote Communications

1. Remote Communications

The control shall include Modbus RTU communications as standard via RS-485 half duplex with configurable baud rates from 2.4k to 57.6k.

2. Remote Monitoring Software

The control shall provide Monitoring Software with the following functionality

A. Monitor up to eight (8) generator sets, plus ATS and UPS.
B. Provide access to all date and events on generator set communications network
C. Provide remote control capability for the generator set(s)
D. Ability to communicate via Modbus RTU or remote modem
E. Ability to communicate email/text alerts.

H. Annunciation

1. Remote Annunciator (NFPA 99/110, CSA 282)

Provide a remote annunciator to meet the requirements of NFPA 110, Level 1.

A. The annunciator shall incorporate ring-back capability so that after silencing the initial alarm, any subsequent alarms will sound the horn.
B. Ability to be located up to 4000 ft from the generator set
C. The annunciator shall provide remote annunciation of all points listed below:
1. Overcrank
2. Low coolant temperature
3. High coolant temperature warning
4. High coolant temperature shutdown
5. Low oil pressure warning
6. Low oil pressure shutdown
7. Overspeed
8. Low coolant level
9. EPS supplying load
10. Control switch not in auto
11. High battery voltage
12. Low battery voltage
13. Battery charger AC failure
14. Emergency stop
15. Spare
16. Spare

2.5 COOLING SYSTEM

The generator set shall be equipped with a rail-mounted, engine-driven radiator with blower fan and all accessories. The cooling system shall be sized to operate at full load conditions and 110 F* ambient air entering the room or enclosure (If an enclosure is specified). The generator set supplier is responsible for providing a properly sized cooling system based on the enclosure static pressure restriction.

2.6 FUEL SYSTEM

A. Fuel System

The fuel system shall be integral with the engine. In addition to the standard fuel filters provided by the engine manufacturer, there shall also be installed a primary fuel filter/water separator in the fuel inlet line to the engine. All fuel piping shall be black iron or flexible fuel hose rated for this service. No galvanized piping will be permitted. Flexible fuel lines shall be minimally rated for 300 degrees F and 100 psi. Include fuel 3/4 full in bid.

B. Fuel Sub Base Tank

Provide a double wall sub-base tank constructed to meet all local codes and requirements. A fuel tank base of 24 hour capacity shall be provided as an integral part of the enclosure. It shall be contained in a rupture

basin with 110% capacity. The tank shall meet UL142 standards. A locking fill cap, a mechanical reading fuel level gauge, low fuel level alarm contact, and fuel tank rupture alarm contact shall be provided.

2.8 STARTING SYSTEM

A. Starting Motor

A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be as recommended by the engine manufacturer.

B. Jacket Water Heater

Jacket water heater shall be provided and shall be sized to insure that genset will start within the specified time period and ambient conditions.

C. Batteries

Batteries - A lead-acid storage battery set of the heavy-duty diesel starting type shall be provided. Battery voltage shall be compatible with the starting system.

D. Battery Charger

A UL listed/CSA certified 10 amp voltage regulated battery charger shall be provided for each engine-generator set. Input AC voltage and DC output voltage shall be as required. Chargers shall be equipped with float and equalize charge settings, with provisions to automatically switch between the two modes. It shall maintain its rated output voltage within ±0.2% with AC input variation of ±10%. Operational monitors shall provide with individual form C contacts rated at 4 amps, 120 VAC, 30VDC for remote indication of battery charger malfunction, low battery voltage, and high battery voltage. Charger shall include an Analog DC voltmeter and ammeter and fused AC input and DC output, and shall be wall mount type in a NEMA 1 enclosure.

2.9 ENCLOSURE

A. Attenuated Enclosure

The complete diesel engine generator set, including generator control panel, engine starting batteries and fuel oil tank, shall be enclosed in a factory assembled, sound attenuated enclosure mounted on the fuel tank base. Enclosure shall be rated for min. 180MPH.

A. A weather resistant, sound attenuated enclosure of steel with electrostatically applied powder coated baked polyester paint. The enclosure shall have a resulting sound level of ___dba @____ft with the genset running under full load. It shall consist of a roof, side walls, and end walls. Fasteners shall be either zinc plated or stainless steel.

B. Enclosure Sound Attenuation: Acoustical foam shall be provided between all supports and inside doors and sound baffles on air intake and air discharge.

PART 3- EXECUTION

3.1 INSTALLATION

Install equipment in accordance with manufacturer's recommendations, the project drawings and specifications, and all applicable codes.

3.2 START-UP AND TESTING

Coordinate all start-up and testing activities with the Engineer and Owner. After installation is complete and normal power is available, the manufacturer's local dealer shall perform the following:
Perform a 4 hour load bank test at a 1.0 PF at full nameplate rating. Loadbank, cables and other equipment required for this test to be supplied by the genset supplier.

3.3 OPERATION AND MAINTENANCE MANUALS

Provide two (2) sets of operation and maintenance manuals covering the generator, switchgear, and auxiliary components. Include final as-built wiring interconnect diagrams and recommended preventative maintenance schedules.

3.4 TRAINING

A. On-Site Training

Provide on-site training to instruct the owner's personnel in the proper operation and maintenance of the equipment. Review operation and maintenance manuals, parts manuals, and emergency service procedures.

END OF SECTION

SECTION 26 36 00

ENCLOSED AUTOMATIC TRANSFER SWITCH

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches
2. Remote annunciation systems

B. Related Sections include the following:

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

1. Technical data on all major components of all transfer switches and other products described in this section. Data is required for the transfer switch mechanism, control system, cabinet, and protective devices specifically listed for use with each transfer switch. Include steady state and fault current ratings, weights, operating characteristics, and furnished specialties and accessories.

2. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.

1. Dimensioned outline drawings of assembly, including elevations, sections, and details including minimal clearances, conductor entry provisions, gutter space, installed features and devices and material lists for each switch specified.
2. Internal electrical wiring and control drawings.
3. Interconnection wiring diagrams, showing recommended conduit runs and point-to-point terminal connections to generator set.
4. Installation and mounting instructions, including information for proper installation of equipment to meet seismic requirements.

C. Manufacturer and Supplier Qualification Data

1. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.
2. The manufacturer of this equipment shall have produced similar equipment for a minimum period of 10 years. When requested, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays, timers and protective devices; provide setting and calibration instructions where applicable.

E. Warranty documents demonstrating compliance with the project's contract requirements.

1.4 QUALITY ASSURANCE

A. Only approved bidders shall supply equipment provided under this contract.

B. Manufacturer Qualifications: The equipment supplier shall maintain a service center capable of providing training, parts, maintenance and emergency repairs to equipment, including transfer switch generator sets and remote monitoring equipment (if applicable) at the site within a response period of less than (eight hours or appropriate time period designated for Project) from time of notification.

1. The transfer switch shall be serviced by technicians employed by, and specially trained and certified by, the generator set supplier and the supplier shall have a service organization that is factory-certified in both generator set and transfer switch service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.
2. Submit names, experience level, training certifications, and locations for technicians that will be responsible for servicing equipment at this site.
3. The manufacturer shall maintain model and serial number records of each transfer switch provided for at least 20 years.

C. Source Limitations: All transfer switches are to be obtained through one source from a single manufacturer. The generator set manufacturer shall warrant transfer switches to provide a single source of responsibility for products provided.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked as suitable for use in emergency, legally required or optional standby use as appropriate for the connected load.

E. The automatic transfer switch installation and application shall conform to the requirements of the following codes and standards:

1. Transfer switches and enclosures shall be UL 1008 listed and labeled as suitable for use in emergency, legally required, and optional standby applications.
2. CSA 282, Emergency Electrical Power Supply for Buildings, and CSA C22.2, No. 14-M91 Industrial Control Equipment
3. NFPA 70, National Electrical Code. Equipment shall be suitable for use in systems in compliance with Articles 700, 701 and 702.
4. Comply with NEMA ICS 10-1993 AC Automatic Transfer Switches

5. IBC 2006 – The transfer switch(es) shall be prototype-tested and third-party certified to comply with the requirements of IBC group III or IV, Category D/F. The equipment shall be shipped with the installation instructions necessary to attain installation compliance
6. IEEE 446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
7. EN55011, Class B Radiated Emissions and Class B Conducted Emissions
8. IEC 1000-4-5 (EN 61000-4-5); AC Surge Immunity
9. IEC 1000-4-4 (EN 61000-4-4) Fast Transients Immunity
10. IEC 1000-4-2 (EN 61000-4-2) Electrostatic Discharge Immunity
11. IEC 1000-4-3 (EN 61000-4-3) Radiated Field Immunity
12. IEC 1000-4-6 Conducted Field Immunity
13. IEC 1000-4-11 Voltage Dip Immunity
14. IEEE 62.41, AC Voltage Surge Immunity
15. IEEE 62.45, AC Voltage Surge Testing

F. Comply with NFPA 110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for Level 1 systems, regardless of the actual circuit level.

G. The manufacturer shall warrant the material and workmanship of the transfer switch equipment for a minimum of one (1) year from registered commissioning and start-up, or eighteen (18) months from date of shipment.

H. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, and etc. during the minimum noted warranty period described above.

1.5 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:

1. Notify (Architect/Construction Manager/Owner) no fewer than (insert appropriate number) days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without (Architect/Construction Manager/Owner's) written permission.
3. Do not energize any new service or distribution equipment without notification and permission of the (Architect/Construction Manager/Owner).

1.6 COORDINATION

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ASCO

2. GE / Zenith

3. Eaton

B. Switches manufactured by Zenith, Eaton, or ASCO that meet the requirement of this specification are acceptable, if approved not less than two weeks before scheduled bid date. Proposals must include a line-by-line compliance statement based on this specification.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Provide transfer switches in the number and ratings that are shown on the drawings. 600 OTPC, BY-PASS, level 1 controls, Nema 3R enclosure. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer.

B. Fault-Current Closing and Withstand Ratings: UL 1008 WCR ratings must be specifically listed as meeting the requirements for use with protective devices at installation locations, under specified fault conditions. Withstand and closing ratings shall be based on use of the same set of contacts for the withstand test and the closing test.

C. Solid-State Controls: All settings should be accurate to +/- 2% or better over an operating temperature range of - 40 to + 60 degrees C (- 40 to + 140 degrees F).

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplished by a non-fused, momentarily energized solenoid or electric motor operator mechanism, mechanically and electrically interlocked in both directions (except that mechanical interlock is not required for closed transition switches).

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Switches using molded-case switches or circuit breakers, or insulated case circuit breaker components are not acceptable.
2. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the Source 1 and Source 2 positions.
3. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.
4. Contacts shall be operated by a high-speed electrical mechanism that causes contacts to open or close within three electrical cycles from signal.
5. The transfer switch operation shall include the ability to switch to an open position (both sources disconnected) for the purpose of load shedding from the generator set.
6. The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical, but must be coordinated with control function.
7. Transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with components that could be operating at line voltage levels.
8. The transfer switch shall include the mechanical and control provisions necessary to allow the device to be field-configured for operating speed. Transfer switch operation with motor loads shall be as is recommended in NEMA MG1.
    a. Phase angle monitoring/timing equipment is not an acceptable substitute for this functionality
9. Transfer switches designated on the drawings as “4-pole” shall be provided with a switched neutral pole switched which is switched simultaneously with phase poles..

G. Control: Transfer switch control shall be capable of communicating with the genset control, other switches and remote programming devices over a high-speed network interface.

H. Factory wiring: Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism

I. Terminals: Terminals shall be pressure type and appropriate for all field wiring. Terminal arrangement and cabinet space must be such that feeder conductors can enter from the top, side or bottom of the switch, at the installer's discretion. Control wiring shall be equipped with suitable lugs, for connection to terminal strips.

J. Enclosures: All enclosures shall be third-party certified for compliance to NEMA ICS 6 and UL 508, unless otherwise indicated:

1. The enclosure shall provide wire bend space in compliance to the latest version of NFPA70, regardless of the direction from which the conduit enters the enclosure.
2. Exterior cabinet doors shall provide complete protection for the system's internal components. Doors must have permanently mounted key-type latches. Bolted covers or doors are not acceptable.
3. Transfer switches shall be provided in enclosures that are third party certified for their intended environment per NEMA requirements.
    a. Transfer switches mounted in a controlled indoor environment shall be provided in NEMA Type 1 enclosures (IEC type IP30).

2.3 AUTOMATIC TRANSFER SWITCHES

A. Comply with requirements for Level 1 equipment according to NFPA 110.

B. Indicated current ratings:

1. Refer to the Project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, number of poles, voltage and ampere ratings, enclosure type, and accessories.
2. Main contacts shall be rated for 600 VAC minimum.
3. Transfer switches shall be rated to carry 100% of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C (-40 to +140 degrees F), relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000 meters).

C. Relay Signal: Control shall include provisions for addition of a pre-transfer relay signal, adjustable from 0 to 60 seconds, to be provided if necessary for elevator operation, based on equipment provided for the project..

D. Control: Transfer switch control shall be provided with necessary equipment and software to communicate with the genset control, other transfer switches, remote annunciation equipment, and other devices over a high speed control network.

E. Neutral Switching: Transfer switches designated on the drawings as 4-pole shall be provided with a switched neutral pole. The neutral pole shall be of the same construction and have the same ratings as the phase poles. All poles shall be switched simultaneously using a common crossbar. Substitute equipment using overlapping neutral contacts is not acceptable.

F. The transfer switch physically located closest to the generator and not more than 50 ft (15 meters) away, except those served by generator paralleling equipment, shall be provided with a battery charger suitable for the requirements of the application and in compliance with NFPA 110 requirements for Level 1 systems. If no transfer switch is located within this distance, a battery charger shall be installed on the generator set.

G. Automatic Transfer Switch Control Features

1. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600 VAC. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are not acceptable.
2. All transfer switch sensing shall be configurable from an operator panel or from a Windows XP or later PC-based service tool. Designs utilizing DIP switches or other electromechanical devices are not acceptable.
3. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device for load shedding purposes. On receipt of this signal, the transfer switch shall switch to a neutral position when connected to Source 2. If Source 1 is available when the load-shed signal is received, the transfer switch shall connect to Source 1.
4. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device to prevent transfer to the generator service.
5. The transfer switch shall provide a relay contact signal prior to transfer or re-transfer. The time period before and after transfer shall be adjustable in a range of 0 to 50 seconds.
6. The control system shall be designed and prototype tested for operation in ambient temperatures from - 40 degrees C to + 60 degrees C (- 40 to +140 degrees F). It shall be designed and tested to comply with the requirements of the noted voltage and RFI/EMI standards.
7. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.
8. The transfer switch network monitoring equipment, when supplied, shall be provided with a battery-based auxiliary power supply to allow monitoring of the transfer switch when both AC power sources are non-operational. The battery power supply shall be monitored for proper condition, and the transfer switch shall include an alarm condition to indicate low battery condition.

H. Transfer Switch Control Panel: The transfer switch shall have a microprocessor-based control with a sealed membrane panel incorporating pushbuttons for operator-controlled functions, and LED lamps for system status indicators. The panel shall also include an alphanumeric display for detailed system information. Panel display and indicating lamps shall include permanent labels.

1. The indicator panel LEDs shall display:

   a. Which source the load is connected to (Source 1 or Source 2)
   b. Which source or sources are available
   c. When switch is not set for automatic operation, because the control is disabled or the bypass switch is in use
   d. When the switch is in test/exercise mode

2. The indicator shall have pushbuttons that allow the operator to activate the following functions:

   a. Activate pre-programmed test sequence
   b. Override programmed delays, and immediately go to the next operation
   c. Reset the control by clearing any faults
   d. Test all of the LEDs by lighting them simultaneously

3. The alphanumeric digital display shall be vacuum fluorescent-type, clearly visible in both bright sunlight and no-light conditions over an angle of 120 degrees, and shall display the following:

a. AC voltage for all phases, normal and emergency
b. Source status: connected or not connected.
c. Load data, including voltage, AC current, frequency, KW, KVA, and power factor.

4. The display panel shall be password-protected, and allow the operator to view and make adjustments:

a. Set nominal voltage and frequency for the transfer switch
b. Adjust voltage and frequency sensor operation set points
c. Set up time clock functions
d. Set up load sequence functions
e. Enable or disable control functions including program transition
f. View real-time clock data, operation log (hours connected, times transferred, failures) and service history

I. Control Functions: Functions managed by the control shall include:

1. Software adjustable time delays:

a. Engine start (prevents nuisance genset starts in the event of momentary power fluctuation): 0 to 120 seconds (default 3 sec)
b. Transfer normal to emergency (allows genset to stabilize before load is transferred): 0 to 120 seconds (default 3 sec)
c. Re-transfer emergency to normal (allows utility to stabilize before load is transferred from genset): 0 to 30 minutes (default 3 sec)
d. Engine cooldown: 0 to 30 minutes (default 10 min)
e. Programmed transition: 0 to 60 seconds (default 3 sec)

2. Undervoltage sensing: three-phase normal, three-phase emergency source.

a. Pickup: 85 to 98% of nominal voltage (default 90%)
b. Dropout: 75 to 98% of nominal voltage (default 90%)
c. Dropout time delay: 0.1 to 1.0 seconds (default 0.5 sec)
d. Accurate to within +/- 1% of nominal voltage

3. Over-voltage sensing: three-phase normal, three-phase emergency source.

a. Pickup: 95 to 99% of dropout setting (default 95%)
b. Dropout: 105 to 135% of nominal voltage (default 110%)
c. Dropout time delay: 0.5 to 120 seconds (default 3 sec)
d. Accurate to within +/- 1% of nominal voltage

4. Over/under frequency sensing:

a. Pickup: +/- 5 to +/-20% of nominal frequency (default 10%)
b. Dropout: +/-1% beyond pickup (default 1%)
c. Dropout time delay: 0.1 to 15.0 seconds (default 5 sec)
d. Accurate to within +/- 0.2%

5. Voltage imbalance sensing:

a. Dropout: 2 to 10% (default 4%)
b. Pickup: 90% of dropout
c. Time delay: 2.0 to 20 seconds (default 5 sec)

6. Phase rotation sensing:

    a. Time delay: 100 msec

7. Loss of single-phase detection:

    a. Time delay: 100 msec

J. Control features shall include:

1. Programmable genset exerciser: A field-programmable control shall periodically start the generator, transfer the load to generator for a preset time, then re-transfer and shut down the generator after a preset cool-down period.

    a. Push-button programming control shall have a selection of eight different schedules for exercising generator, with or without load.

2. In event of a loss of power to the control, all control settings, real-time clock setting and the engine start-time delay setting will be retained.
3. The system continuously logs information including the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. An event recorder stores information, including time and date-stamp, for up to 50 events.
4. Transfer Override Switch: Overrides automatic re-transfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light to indicate override status.

K. Control Interface

1. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.
2. The transfer switch shall be provided with a network communication card, and configured to allow network-based communication with the transfer switch and other network system components, including the generator set(s) provided for the Project.
3. Unassigned Auxiliary Contacts: Two normally open, 1-pole, double-throw contacts for each switch position, rated 10A at 240 VAC.

L. Engine Starting Contacts

1. One isolated and normally closed, and one isolated and normally open; rated 10A at 32 VDC minimum.

2.4 REMOTE ANNUNCIATOR SYSTEM

A. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:

1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
2. Switch position.
3. Switch in test mode.
4. Failure of communication link.

B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.

1. Indicating Lights: Grouped for each transfer switch monitored.
2. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
3. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
4. Lamp Test: Push-to-test or lamp-test switch on front panel.

C. Malfunction of annunciator, annunciation and control panel, or communication link shall not affect functions of automatic transfer switch. In the event of failure of communication link, automatic transfer switch automatically reverts to stand-alone, self-contained operation.

D. Automatic transfer-switch sensing, controlling, or operating function shall not depend on remote panel for proper operation. The remote annunciation system shall not prevent transfer to the alternate source when the primary power source fails, nor prevent return to the primary source if the alternate source fails

PART 3 - EXECUTION

3.1 INSTALLATION

A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Floor-Mounting Switch: Anchor to floor by bolting.

1. Floor-mounted transfer switches (except drawout switches supported by wheeled carriages, which must be rolled out at floor level) shall be mounted on concrete bases complying with the following requirements:

a. Concrete Bases: 4 inches (100 mm) high, reinforced, with chamfered edges. Extend base no more than 4 inches (100 mm) in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support. Construct concrete bases according to Division 26 Section "Hangers and Supports for Electrical Systems."

C. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.

D. Identify components according to Division 26 Section "Identification for Electrical Systems."

E. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.

C. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the switch. Lugs shall be suitable for the number and size of conductors shown on the drawings.

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 SOURCE QUALITY CONTROL

A. Prior to shipping, factory shall test and inspect components, assembled switches, and associated equipment to ensure proper operation.

B. Factory shall check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements.

C. Factory shall perform dielectric strength test complying with NEMA ICS 1.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: The supplier of the transfer switch(es) and associated equipment shall inspect, test, and adjust components, assemblies, and equipment installations, including connections, and report results in writing.

B. Manufacturer’s representative shall perform tests and inspections and prepare test reports.

C. After installing equipment and after electrical circuitry has been energized, installer shall test for compliance with requirements.

1. Perform recommended installation tests as recommended in manufacturer’s installation and service manuals.

2. After energizing circuits, demonstrate interlocking sequence and operational function for each switch.

    a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
    b. Verify time-delay settings.
    c. Verify that the transfer switch is accurately metering AC voltage and current (when provided).
    d. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
    e. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

3. Ground-Fault Tests (if integral to transfer switch): Coordinate with testing of ground-fault protective devices for power delivery from both sources.

    a. Verify grounding connections and locations and ratings of sensors.

D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 DEMONSTRATION

A. After generator set installation, the generator and transfer switch supplier shall conduct a complete operation, basic maintenance, and emergency service seminar covering generator set and transfer switch equipment, for up to 10 people employed by the Owner.

1. The seminar shall include instruction on operation of the transfer equipment, normal testing and exercise, adjustments to the control system, use of the PC based service and maintenance tools provided under this contract, and emergency operation procedures.
2. The class duration shall be at least 8 hours in length, and include practical operation with the installed equipment.

3.6 SERVICE AND SUPPORT

A. The manufacturer shall supply the Owner with a complete set of the service and maintenance software required to support the product. The software shall be provided at a training class attended by the user, to qualify the user in proper use of the software. The software shall have the following features and capabilities:

1. The software shall be 32 bit and shall be XP and Vista compatible.
2. The software shall use the Windows Explorer format, for ease of use and commonality with other software in use at the facility.
3. The software shall allow adjustment of all functions described herein, adjustment of operating levels of all protective functions, and programming of all optional functions in the controller. Adjustments shall be possible over modem from a facility that is remote from the generator set.
4. The software shall be capable of storing and displaying data for any function monitored by the generator set control. This data shall be available in common file formats, and on graphical “strip chart” displays.
5. The software shall automatically record all control operations and adjustments performed by any operator or software user, for tracking of changes to the control.
6. The software shall display all warning, shutdown, and status changes programmed into transfer switch controller. For each event, the control shall provide information on the nature of the event, when it last occurred, and how many times it has occurred.

END OF SECTION

SECTION 26 43 13

SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions, apply to work covered by this Section.

B. Comply with Electrical Sections, as applicable. Refer to other Sections for coordination of work.

1.2 SCOPE OF WORK

A. Provide labor, material, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of a high-energy power conditioning surge protection device(s) at branch circuit panelboards where indicated on the Drawings. The device shall incorporate transient voltage surge suppression (TVSS) and high-frequency electrical line noise filtering. The device shall provide effective high energy transient voltage suppression, surge current diversion, high-frequency attenuation, and line stabilization in ANSI/IEEE C62.41-2002 environments connected downstream from the facility's main overcurrent protective device. The device shall be connected in parallel with the facility's wiring system.

B. The device shall be installed as an integral part or external of the panelboard, switchboard.

1.3 SUBMITTALS

A. Submit product data and shop drawings for products specified under PART 2 - PRODUCTS.

B. Manufacturers' Product Data: Submit material specifications and installation data for products specified under PART 2 - PRODUCTS.

C.

D. Shop Drawings: Submit shop drawings to indicate information not fully described by the product data to indicate compliance with the contract documents.

1 Include electrical characteristics and ratings for the specified equipment.

2 Include wiring diagrams indicating the internal connections of the specified equipment within its enclosure.

3 Drawings shall be provided indicating device dimensions, weights, mounting provisions, connection details and wiring diagrams.

4 Documentation of the specified device UL 1449 3rd Edition voltage protection rating (VPR) and per mode surge current rating shall be included. All submittals without this documentation will be rejected.

5 The manufacturer shall make available upon request certified documentation of applicable Location Category Testing in full compliance with ANSI/IEEE C62.41-1991 and ANSI/IEEE C62.45-1987 Guidelines.

E. Record Drawings

1 A complete set of manufacturers' product data and shop drawings indicating all post bid revisions and field changes.

1.4 QUALITY ASSURANCE

A. Industry Reference Standards and Publications: The device shall be designed, manufactured, tested and installed in compliance with the latest editions of:

1 American National Standards Institute (ANSI) and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.41-2002 and C62.45-2002)

2 Federal Information Processing Standards Publication 94 (FIPS PUB 94)

3 National Electrical Manufacturers Association (NEMA LS-1)

4 National Fire Protection Association (NFPA 70, National Electrical Code (NEC), 75 and 78)

5 Underwriters Laboratories UL 1449 Standard for Transient Voltage Surge Suppressors Surge Protection Devices and UL 1283 Standard for Electromagnetic Interference Filters.

B. The device shall be UL listed under UL 1449 and UL 1283 complimentary listed.

C. The device shall be warranted against defects in material and/or workmanship and any failure or end-of-life event including lighting for a minimum of TEN (10) years from the date of shipment.

D.

E. The device shall be thoroughly factory-tested before shipment. Testing of the device shall include but not be limited to quality control checks, maximum continuous operating voltage (MCOV) check, and clamping voltage verification

tests. The MCOV check shall consist of a minimum of one (1) hour burn-in at the applicable MCOV.

F.

1.5 SYSTEM DESCRIPTION

A. Environmental Requirements

1 Storage Temperature: Storage temperature range shall be -40º to +85º C (-40º to +185º F).

2 Operating Temperature: Operating temperature range shall be -40º to +60º C (-40º to 140º F).

3 Relative Humidity: Operation shall be reliable in an environment with 5% to 95% non-condensing relative humidity.

4 Operating Altitude: The device shall be capable of operation in an altitude of 0 - 12,000 feet above sea level.

5 Audible Noise: The device shall not generate any audible noise.

6 Magnetic Fields: No appreciable magnetic fields shall be generated. The device shall be capable of use directly in computer rooms in any location without danger to data storage systems or devices.

7 Electrical Requirements

8 Device Operating Voltage: The nominal operating voltage and configuration shall be that of the switchgear, distribution panel, sub or branch panelboard. Maximum Continuous Operating Voltage (MCOV): The allowable maximum continuous operating voltage of all suppression components utilized in the unit shall not be less than 115% of the nominal operating voltage.

9 Operating Frequency: The operating frequency range of the device shall be 47 to 63 Hertz.

10Protection Modes: The devices primary mode of protection shall be line-to-neutral. The secondary modes of protection shall be line-to-ground and neutral-to-ground.

11Surge Current Capacity and Voltage Protection Rating: Unless specifically noted on the drawings and/or the schedules, the surge current capacity, and the voltage protection rating of the SPD shall be not less than listed on the following table.

The above text gives you the option to request a specific surge current rating on the riser or panel schedules

5. Construction: SPD's with a surge current rating of greater than 155,000 amps per mode shall be field serviceable modular devices. SPD's with a surge current rating of less than 155,000 amps may be non-modular.

Location	Per Mode Surge Current Rating	120/208vac 3 phase VPR	277/480vac 3 phase VPR
Switchgear	200,000 amps	900v	1200v
Distribution Panel	150,000 amps	900v	1200v
Sub or Branch Panel	100,000 amps	900v	1200v

1.6 DOCUMENTATION

A. Equipment Manual. The manufacturer shall furnish an equipment manual with installation, operation, and maintenance instructions for the system.

PART 2 - PRODUCTS

3.1 MANUFACTURER

1 Square D

2 Cutler-Hammer

3 Current Technology

4 THOR SYSTEMS

3.2 TRANSIENT VOLTAGE SURGE SUPPRESSION COMPONENTS

A. The device shall include a solid-state suppression system which includes arrays of fused non-linear voltage dependent metal oxide varistors (MOV's) with similar operating characteristics. The suppression system shall not utilize gas tubes, spark gaps, silicon avalance diodes or other components which might short or crowbar the line, thus leading to interruption of normal power flow to or system upset of connected loads. The suppression system shall not incorporate any other components which may degrade performance or reliability of the

3.3 HIGH-FREQUENCY FILTER

A. The device shall include a UL 1283 high frequency extended range tracking filter. The filter shall reduce fast rise-time, high-frequency, error-producing transients and electrical line noise eliminating disturbances which may lead to system upset. The filter shall provide minimum insertion loss of 45 dB at 100 kHz attenuation frequency utilizing the MIL-STD-E220A 50 ohm insertion loss methodology.

3.4 INTERNAL CONNECTIONS

a. All internal wiring associated with the suppression/filter device and subject to surge currents shall utilize low-impedance copper bus bar and/or #4 AWG copper conductor or larger. All internal connections associated with the suppression/filter device and subject to

surge currents shall be made with compression solderless-type lugs and shall be bolted to the bus

bars in order to reduce overall system impedance.

3.5 FIELD CONNECTIONS

A. The device shall include mechanical lugs for each phase, neutral and ground, or permanently connected conductors as applicable. The lugs shall accommodate up to #4 AWG copper conductor.

3.6 ENCLOSURE

A. The device shall be provided in a surface mounted NEMA 1 type hinged enclosure, with a NEMA rating that matches or exceeds that of the switchgear, distribution panel, sub or branch panelboard that is being protected. of minimum 14 gauge steel, painted inside and out. Enclosure width shall not be greater than 24 inches.

3.7 MONITORING

a. The device shall include solid-state, long-life externally mounted LED visual status indicators that indicate the on-line status of each phase of the unit.
b. Dry Contacts
c. Audible alarm with silence switch
d. For Service Entrance or Switchgear SPD's: LED visual status indicators, Audible alarm with silence switch, Dry Contacts plus Surge Event Counter.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The installation and testing of the system shall be in full accordance with the manufacturer's installation, operation and maintenance instructions, and all national and local codes.

B. The device shall be installed as close as practical to the facility's wiring system in accordance with NEC Article 285, IEEE 1100-2005 section 8.4.2.5, plus applicable national/local electrical codes and the manufacturer's recommended installation instructions. Connection shall be from a minimum 40A branch circuit breaker in the switchgear, distribution panel or panelboard with #4 AWG copper conductors not any longer than necessary, avoiding unnecessary bends. Advise the engineer if the installed In no case shall conductors will be longer than 3 feet in length. Verify circuit breaker size with manufacturer.

3.2 TESTING

A. The system shall be field tested in the presence of the Owner. At the same time operational procedures shall be reviewed with the Owner.

B. If external test equipment is required, two (2) testers shall be furnished to the owner and two (2) training sessions shall be furnished. The first training session shall be with 90 days of occupancy and the second training session shall be not less eight months, but not more than 12 months after the first training session. Training and test equipment shall be furnished at no additional cost to the owner.

END OF SECTION

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

A. This Section includes interior lighting fixtures, lighting fixtures mounted on exterior building surfaces, emergency lighting units, and accessories.

B. Related Sections include the following:

1.3 SUBMITTALS

A. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:

1. Dimensions of fixtures.
2. Select one of two subparagraphs below. With second subparagraph, photometric tests by manufacturer's laboratory are acceptable.
3. Certified results of laboratory tests for fixtures and lamps for photometric performance.
4. Emergency lighting unit battery and charger.
5. LED lights
6. Retain two subparagraphs below for projects with air-handling fixtures.
7. Types of lamps.

B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, method of field assembly, components, features, and accessories.

1. Wiring Diagrams: Detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.

C. Consider retaining paragraph below for projects with congested ceiling space and where Drawings do not include comprehensive reflected ceiling plans.

D. Coordination Drawings: Reflected ceiling plans and sections drawn to scale and coordinating fixture installation with ceiling grid, ceiling-mounted items, and other components in the vicinity. Include work of all trades that is to be installed near lighting equipment.

E. Product Certificates: Signed by manufacturers of lighting fixtures certifying that products comply with requirements.

F. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

G. Maintenance Data: For lighting fixtures to include in maintenance manuals in the close out documents.

1.4 QUALITY ASSURANCE

A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an acceptable to authorities having jurisdiction.

B. Comply with NFPA 70.

C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.5 COORDINATION

A. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in the Interior Lighting Fixture Schedule at the end of Part 3.

B. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Interior Lighting Fixture Schedule in the plans. Submit Manufacturers as is in the Lighting Fixture Schedule or Equal. Submit Equal Manufacturers 10 days prior to bidding day for approval. For Equal Manufacturers submit lighting calculation for each equal fixture submitted for approval.

2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs, sharp corners, and edges.

B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.

D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.

1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
2. Lens Thickness: 0.125 inch (3 mm) minimum, unless greater thickness is indicated.

2.3 LED FIXTURES

A. Except as otherwise indicated, provide LED luminaires, of types and sizes indicated on fixture schedules.

B. Include the following features unless otherwise indicated:

1. Each Luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply).

2. Each luminaire shall be rated for a minimum operational life of 50,000 hours utilizing a minimum ambient temperature of (25°C).

3. Light Emitting Diodes tested under LM-80 Standards for a minimum of 12,000 hours.
4. Color Rendering Index (CRI) of 82 at a minimum.
5. Color temperature [3500] <Insert value> K, unless otherwise indicated.
6. Rated lumen maintenance at 70% lumen output for 50,000 hours, unless otherwise indicated.
7. Fixture efficacy of 60 Lumens/Watt, minimum.
8. 5 year luminaire warranty, minimum.
9. Photometry must comply with IESNA LM-79.
10. The individual LEDs shall be constructed such that a catastrophic loss of the failure of one LED will not result in the loss of the entire luminaire.
11. Luminaire shall be constructed such that LED modules may be replaced or repaired without the replacement of the whole fixture.

C. Technical Requirements

1. Luminaire shall have a minimum efficacy of 60 lumens per watt. The luminaire shall not consume power in the off state.
2. Operation Voltage: The luminaire shall operate from a 50 HZ to 60 HZ AC line over a voltage ranging from 120 VAC to 277 VAC. The fluctuations of line voltage shall have no visible effect on the luminous output.
3. Power Factor: The luminaire shall have a power factor of 0.9 or greater.
4. THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 15 percent.

5. Operational Performance: The LED circuitry shall prevent visible flicker to the unaided eye over the voltage range specified above.

D. Thermal Management

1. The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the luminaire over the expected useful life.
2. The LED manufacturer's maximum thermal pad temperature for the expected life shall not be exceeded.
3. Thermal management shall be passive by design. The use of fans or other mechanical devices shall not be allowed.
4. The luminaire shall have a minimum heat sink surface such that LED manufacturer's maximum junction temperature is not exceeded at maximum rated ambient temperature.

2.4 LED EXIT SIGNS

A. Exit light fixtures shall meet applicable requirements of NFPA and UL.
B. Housing and door shall be die-cast aluminum.
C. For general purpose exit light fixtures, door frame shall be hinged, with latch. For vandal-resistant exit light fixtures, door frame shall be secured with tamper-resistant screws.
D. Finish shall be satin or fine-grain brushed aluminum.
E. There shall be no radioactive material used in the fixtures.
F. Fixtures:
1. Inscription panels shall be cast or stamped aluminum a minimum of 2.25 mm (0.090 inch) thick, stenciled with 150 mm (6 inch) high letters, baked with red color stable plastic or fiberglass. Lamps shall be luminous Light Emitting Diodes (LED) mounted in center of letters on red color stable plastic or fiberglass.
2. Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.
3. Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.

G. Voltage: Multi-voltage (120 – 277V).

2.5 EMERGENCY LIGHTING UNITS

A. General Requirements: Self-contained units. Comply with UL 924. Units include the following features:
1. Battery: Sealed, maintenance-free, lead-acid type with minimum 5-year nominal life and special warranty.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps, and battery is automatically recharged and floated on charger.

2.6 LAMPS

A. ALL LED – NO LAMPS

2.7 FINISHES

A. Fixtures: Manufacturer's standard, unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture.
B. NFPA 70 requires minimum support for fixtures. Retain paragraphs below for more specific support requirements and for requirements exceeding code minimums. Units in seismic zones must have additional supports and restraining devices beyond those specified here. See Editing Instruction No. 3 in the Evaluations.
C. Support for Fixtures in or on Grid-Type Suspended Ceilings: Do not use grid for support.

1. Install a minimum of two ceiling support system wires for each fixture. Locate not more than 6 inches (150 mm) from fixture corners.
2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner.
3. Fixtures of Sizes Less Than Ceiling Grid: Arrange as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.

D. Suspended Fixture Support: As follows:
1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

3.2 CONNECTIONS

A. Ground equipment.
1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
B. Advance Notice: Give dates and times for field tests.
C. Provide instruments to make and record test results.
D. Tests: As follows:
1. Verify normal operation of each fixture after installation.
2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.
3. Verify normal transfer to battery source and retransfer to normal.
4. Report results in writing.

E. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.
F. Corrosive Fixtures: Replace during warranty period.

3.4 CLEANING AND ADJUSTING

A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.
B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION

SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes exterior lighting units with luminaries and lamps.

B. Related Sections include the following:

1. Section "Interior Lighting" for interior fixtures, lamps, ballasts, emergency lighting units, and accessories; and for exterior luminaires normally mounted on buildings.

1.3 DEFINITIONS

A. Lighting Unit: A luminaire or an assembly of luminaires complete with a common support, including pole, post, or other structure, and mounting and support accessories.

B. Luminaire (Light Fixture): A complete lighting device consisting of lamp(s) and ballast(s), when applicable, together with parts designed to distribute light, to position and protect lamps, and to connect lamps to power supply.

1.4 SUBMITTALS

A. Product Data: For each type of lighting unit indicated, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Materials and dimensions of luminaries.
2. Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric data.
3. Certified results of laboratory tests for fixtures and lamps for photometric performance.
4. High-intensity-discharge luminaire ballasts.

B. Product Certificates: Signed by manufacturers of lighting units certifying that products comply with requirements.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

D. Maintenance Data: For lighting units to include in maintenance manuals specified in other sections.

1.5 QUALITY ASSURANCE

A. Luminaires and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for their indicated use, location, and installation conditions by acceptable to authorities having jurisdiction

B. Comply with ANSI C2.

C. Comply with NFPA 70.

1.6 WARRANTY

A. General Warranty: LED fixture warranty is a five year limited warranty. Pole standard warranty is one year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in the Exterior Lighting Unit Schedule at the end of Part 3.

B. Retain above for nonproprietary or below for semiproprietary Specification, and name products in schedules or details.

C. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Interior Lighting Fixture Schedule in the plans. Submit Manufacturers as is in the Lighting Fixture Schedule or Equal. Submit Equal Manufacturers 10 days prior to bidding day for approval. For Equal Manufacturers submit lighting calculation for each equal fixture submitted for approval.

2.2 LUMINAIRES

A. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

B. Metal Parts: Free from burrs, sharp corners, and edges.

C. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
D. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
E. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position. Provide for door removal for cleaning or replacing lens. Arrange to disconnect ballast when door opens.
F. Exposed Hardware Material: Stainless steel.
G. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
H. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.
I. Lenses and Refractors: Materials as indicated. Use heat- and aging-resistant, resilient gaskets to seal and cushion lens and refractor in luminaire doors.
J. Photoelectric Relays: As follows:
   1. Contact Relays: Single throw, arranged to fail in the on position and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay.
   2. Relay Mounting: In luminaire housing.
K. LED sources shall meet the following requirements:
   1. Operating temperature rating shall be between -40 degrees C (-40 degrees F) and 50 degrees C (120 degrees F).
   2. Correlated Color Temperature (CCT): 4000K
   3. Color Rendering Index (CRI): ≥ 85.
   4. The manufacturer shall have performed reliability tests on the LEDs luminaires complying with Illuminating

LED DRIVERS

A. LED drivers shall meet the following requirements:
   1. Drivers shall have a minimum efficiency of 85%.
   2. Starting Temperature: -40 degrees C (-40 degrees F).
   3. Input Voltage: 120 to 480 (±10%) volt.
   4. Power Supplies: Class I or II output.
   5. Surge Protection: The system must survive 250 repetitive strikes of “C Low” (C Low: 6kV/1.2 x 50 µs, 10kA/8 x 20 µs) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. “C Low” waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
   6. Power Factor (PF): ≥ 0.90.
   7. Total Harmonic Distortion (THD): ≤ 20%.
   8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
   9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.//

PART 3 - EXECUTION

3.1 CONNECTIONS

A. Ground equipment.
   1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Ground metal poles/support structures according to Section "Grounding and Bonding."
   1. Nonmetallic Poles: Ground metallic components of lighting units and foundations. Connect luminaires to grounding system with No. 6 AWG conductor.

3.2 FIELD QUALITY CONTROL

A. Inspect each installed unit for damage. Replace damaged units.
B. Advance Notice: Give dates and times for field tests.
C. Provide instruments to make and record test results.
D. Tests and Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source, and as follows:

3.3 CLEANING AND ADJUSTING

A. Clean units after installation. Use methods and materials recommended by manufacturer.

END OF SECTION

SECTION 267211
EMERGENCY RADIO COMMUNICATION SYSTEM

1.1 GENERAL

A. Provide an in-building radio signal amplification system (RSI M5 Series)to provide complete coverage in the building for the public safety agencies as required by the local AHJ (Authority Having Jurisdiction). System users shall receive and transmit radio signals from their portable radio units within the building. This shall be accomplished utilizing the following components:

1. Bi-Directional Amplifiers (Signal Boosters)
2. Coaxial Cable
3. Antennas
4. Cable taps / directional couplers
5. Connectors
6. Power dividers
7. Other components and interconnecting circuitry as required

B. The system shall comply with the requirements of UL 2524 In-building 2-Way Emergency Radio Communication Enhancement Systems, latest edition of NFPA 72, latest edition of NFPA 1221 and latest edition of IFC Section 510, as referenced.

C. Delegated-Design Submittal: contractor is responsible for providing and obtaining an approved system by the local Authority Having Jurisdiction.

D. The entire system shall meet the requirements of the Fire Department, the Building Department and all other agencies and Authorities Having Jurisdiction (AHJ).

E. The work in this section shall include the responsibility for all permit requirements with the AHJ. Where filings require engineer's signature, documents shall be submitted for his or her review and signature. This responsibility shall include furnishing of required quantities of floor plans, descriptive notes and/or specifications, wiring diagrams, shop drawings and amendment forms.

F. Early completion of the in-building emergency radio communication enhancement system (ERCES) will be required as to permit a Certificate of Occupancy to be obtained in a timely manner.

G. Any permits necessary for the installation of the work shall be obtained prior to the commencement of the work. All permit costs and inspection fees shall be included.

H. The in-building emergency radio communication enhancement system shall use a UL2524 Listed, NFPA 72, NFPA 1221 and IFC 2015 compliant signal booster or approved equal.

1.2 DESIGN REQUIREMENTS

A. In-building emergency radio communication enhancement systems for emergency responders are an integral component of the life safety equipment of a building or structure. The primary function is to provide reliable emergency responder communications at the required signal strength within the specified areas.

B. Critical Areas such as emergency command center, fire pump room, exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations and similar critical areas shall be provided with 100% floor area radio coverage.

C. be provided with 100% floor area radio coverage.

D. General building areas shall be provided with 95% radio coverage, or as specified by AHJ.

E. The In-building emergency radio communication enhancement systems must provide the following signal strengths:

1. Downlink - Minimum signal strength of -95 dBm throughout the coverage area.
2. Uplink - Minimum signal strength of -95 dBm received at the AHJ Radio System.
3. OR as otherwise required by the AHJ.

F. The system shall be complete with all components and wiring required for compliance with all applicable codes and regulations, and for its operations described hereinafter.

G. An approved manufacturer or a qualified and approved vendor shall supply, test and determine locations of components which are required for proper operation as well as to supply, install, test and certify the performance of the complete system. Vendor qualifications must be acceptable to the AHJ.

H. Design may include iBwave software-simulated radio propagation modeling with heat maps showing predicted signal coverage levels within the building. The iBwave design shall be done by iBwave certified personnel.

I. All tests shall be conducted, documented, and signed by a person in possession of an FCC General Radiotelephone Operators License. All testing personnel shall be certified and authorized by the signal booster manufacturer in the installation and operation of their equipment. Personnel qualifications must be acceptable to the AHJ.

J. The system design shall be based on the Radio Solutions, Inc (Norwell, MA) line of Public Safety Signal Boosters, UL 2524, NFPA 72, NFPA 1221, IFC and FCC certified to establish standards of quality for materials and performance. The naming of a specific manufacturer or a catalog number does not waiver any requirement or performance of individual components described in the specifications.

K. Assembly and installation of all components of the Emergency Responder Radio Communication Enhancement System (ERRCES) shall comply with all applicable sections of the National Electrical Code.

L. Survivability from attack by fire shall meet requirements of NFPA 72, NFPA 1221, IFC or as required by the local jurisdiction.

M. The system must comply with all applicable sections of the FCC rules. Signal booster shall have FCC certification prior to installation.

N. Antenna isolation shall be maintained between the donor antenna and all inside antennas (D.A.S.) to a minimum of 20dB under all operating conditions.

1.3 TECHNICAL SPECIFICATIONS AND PERFORMANCE REQUIREMENTS

A. The system specified shall be based upon Radio Solutions, Inc (Norwell, MA) line of Public Safety, UL 2524 Listed and NFPA 72, NFPA 1221, IFC compliant signal boosters.

B. The signal booster shall be a Class B Public Safety type as designated by the FCC or as required by the AHJ.

C. The secondary power supplies, battery chargers and system monitoring shall be fully compliant with NFPA 72, NFPA 1221 and IFC. The signal booster shall have both the primary and the secondary power supplies within a waterproof, type-4 approved enclosure. The secondary power source shall provide full power for ERCES operation for 24 hours (with a 30% derated battery), or as per the AHJ specification.

D. All signal boosters and other active system components must have FCC certification prior to installation. The equipment FCC ID must be shown on the product datasheets and technical submittals. The ID must also be displayed on the product as required by the FCC.

E. The signal booster shall be pre-set by the equipment manufacturer for the frequencies specified by the AHJ. Field tuning of RF filters and duplexers is not allowed.

F. UHF and VHF signal boosters shall be band selective type with a maximum 3dB channel bandwidth of 200KHz (Fc +/- 100KHz) per band. Non-selective wide-band signal boosters shall not be accepted, unless required to cover multiple channels within the same band.

G. Signal Boosters shall have oscillation suppression circuitry to protect the public safety radio system in case of system malfunction or other causes. The oscillation suppression circuit shall not disable the system operation. Systems that immediately disable the signal booster upon oscillation detection shall not be allowed.

H. Signal Boosters shall have uplink noise suppression function to eliminate uplink noise while in standby (i.e. no radio transmission from within a building). Systems that produce any measurable level of uplink noise while in standby shall not be allowed.

I. Signal Booster gain shall be rated at minimum of 80dB, and the gain shall be adjustable in 1dB steps to maximum of 40dB range. System gain shall be set and documented at the time of the final system test.

J. Maximum Propagation delay of the signal booster system shall be the lesser of 14µs (microseconds) or as specified by AHJ.

K. The signal booster system shall include built-in automatic supervision of malfunctions of the signal booster and battery system as per NFPA 1221 NFPA 72 and IFC. Non-OEM equipment add-ons and modifications to comply with this specification shall not be allowed.

L. A dedicated supervised monitoring panel shall be provided within the emergency command center next to the fire alarm panel / annunciator or other location as designated by AHJ to annunciate the status of all signal booster locations. The monitoring panel shall provide visual and labeled indication of the following for each signal booster:

1. Normal AC power
2. Signal booster trouble
3. Antenna Failure
4. Loss of normal AC power
5. Failure of battery charger
6. Low battery capacity

M. The vendor shall verify the system monitoring requirements and the required annunciator location with the AHJ prior to system installation. System monitoring shall be fully compliant with the AHJ requirements.

N. Non-OEM External filters, duplexers, power supplies or other non-OEM additions or modifications of the original equipment shall not be allowed.

O. All signal booster components shall be contained in a single type-4 approved and UL 50e listed watertight enclosure. All enclosures shall be painted red with external labeling as required by the AHJ.

1.4 INSTALLATION REQUIREMENTS

A. Installation of all components of the Emergency Responder Communication Enhancement System shall comply with all applicable sections of the National Electrical Code NFPA-70, NFPA-72, NFPA 1221, IFC and / or as required by the local AHJ.

B. At least 2 independent and reliable power supplies shall be provided as specified in NFPA 72, NFPA 1221 and IFC.

C. The primary power source shall be supplied from a dedicated twenty (20) ampere branch circuit and comply with NFPA-70 National Electrical Code, NFPA 72 and NFPA 1221.

D. The signal booster shall be equipped with a secondary source of power. The secondary source of power shall be a battery system with a dedicated battery charger powered by a separate, dedicated twenty (20) ampere branch circuit. The secondary power supply shall power on automatically when the primary power source is lost. The secondary source of power shall be capable of operating the emergency responder radio coverage enhancement system for a period of at least 24 hours. The battery system shall automatically charge in the presence of

external power input. Battery charger and all other electronic components must be fully enclosed in the same waterproof Type-4 approved enclosure as the signal booster. Batteries for the 24-hour backup power may be enclosed in a separate, Type-4 approved enclosure. External UPS (Uninterruptable Power Supplies) are not acceptable.

E. RF Coaxial Cable shall be a listed, CMP plenum. The cable classification shall be clearly marked on the outer surface of the cable regular intervals.

1.5 ACCEPTANCE AND TEST PROCEDURES

A. Acceptance testing of an in-building radio system is required upon completion of installation.

B. The coverage testing shall be done in accordance with NFPA 72, NFPA 1221, IFC and as required by the local AHJ.

C. All tests shall be conducted, documented, and signed by a person in possession of a current FCC General Radio Operator License.

D. All test records along with system diagrams, iBwave design, equipment specifications, user manuals, RF link budget calculations, battery backup calculation and other design data shall be submitted upon completion of the project, and as required by the AHJ.

END OF SECTION 267211

SECTION 27 00 00

STRUCTURED CABLING SYSTEM

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27 02 00 General Requirements (Structured Cabling Systems and Pathways and Spaces systems for all Voice and Data systems)

27 02 01 Summary

A. This work will provide for the structured cabling system (SCS) for all Voice and Data systems. Work on this project will commence after the award of the bid to a successful bidder. SCS system should be either Commscope Uniprise or Systimax compliant.

B. Installation should be supervised by a BICSI RCDD.

C. OTHER APPROVED MANUFACTURERS

1. PANDUIT

D. As-built documents must be provided for the complete system.

E. Communications cabling must not share conduits with power cables.

F. Telecommunications system shall include the following systems:

1. Structured Cabling System (SCS) For Telecommunications Systems.

2. Pathways for Telecommunications Systems. Coordinate with section 26 requirements.

3. Grounding and Bonding System (GBS) For Telecommunications Systems.

a. All components must be grounded and bonded per ANSI/TIA/EIA-607-B, Commercial Building Grounding and Bonding Requirements for Telecommunications.

b. Components include: Telecommunications Main Grounding Busbar, Telecommunications Grounding Busbar, Bonding Conductor for Telecommunications, Telecommunications Bonding Backbone and Telecommunications Equalizing Bonding Conductor.

c. See Section 26 for requirements.

4. Firestopping for Telecommunications Systems.

a. All penetrations through walls and floors must be sealed with firestopping materials meeting the UL 1479 Standard for Fire Tests of Penetration Firestops standard.

b. The type of product such as sealant, intumescent materials, EZ-path, caulking, pillows, collars, putty or any other products must be suitable for the application per manufacturer instructions.

G. Telecommunications conduits and pathways:

1. There should be at least two, two-inch conduits for all closed ceiling areas.

2. For individual work stations and IP devices such as cameras or access points, one-inch must be provided as a minimum diameter for areas with no suspended ceiling.

3. No cable should be exposed in outdoor areas, hard ceiling areas or areas where there is no drop ceiling.

4. J-hooks are acceptable for drop ceiling areas with no more than 4-5’ spacing between them with proper support from the building structure (do not mount in ceiling drop wire).

5. All conduit and pathways should be sized for no more than 40% fill ratio.

6. A pull wire or rope must be provided for all conduits.

7. For outdoor cable runs, there should not be a cable run longer than 200’ without a pull box or manhole.
8. For indoor cable runs, there should not be a cable run longer than 100’ without a pull box.
9. For conduit runs, there should not be a single bend of more than 90 degrees or more than 180 degrees in total bends for the entire cable run. Wide-angle radius bends should be used.
10. Penetrations between floors should be provided with at least two four-inch conduits or sleeves.

H. Telecommunications Spaces:

1. Communications rooms must be at least 80 sq. ft. in area.
2. Cable tray inside communications rooms must be at least 12” wide extending in the room to be supported in three of the walls of the room forming a T-shaped cable tray.
3. At least two of the communications room walls must be covered with plywood panels A/C grade painted with fire retardant paint.
4. There must be at least three 42RU racks arranged in a row.
5. Air conditioner units for the room must be calculated to keep the communications room temperature between 70 to 75 degrees and relative humidity between 50 to 60%.
6. All the conduits coming into and going from the communications room must be installed by the cable tray location.

27 02 50 Substitutions

A. **Substitution requests:** Substitution requests will be considered only if submitted to Owner’s Representative not less than 7 working days prior to project bid date. Acceptance or rejection of proposed substitution is at Owner’s Representatives sole discretion. No exceptions. Requests for substitutions shall be considered *not approved* unless approval is issued in writing by Owner’s Representative.

B. **Rejection:** For equipment, cabling, wiring, materials, and all other products indicated or specified as *no substitutions* or *no alternates*, Owner does not expect nor desire requests for substitutions and alternate products other than those specified. Owner reserves right for Owner’s Representative to reject proposed substitution requests and submissions of alternates without review or justification.

27 02 65 Warranty

27 02 65.10 Contractors Warranty

A. **General requirements:** Comply with additional requirements in contract general requirements and extended warranties required in other specification sections. Refer to all other sections for specific additional warranty requirements that exceed or are in addition to those of this section.

B. **Contractor warranty:** Provide all services, materials and equipment necessary for successful operation of entire telecommunications system and SCS system for a period of one year after system acceptance. Scope of warranty includes all equipment, devices, wiring, accessories, software, hardware, installation, programming, and configuration required to maintain a complete and operable system. Provide manufacturer’s published recommended preventative maintenance procedures during warranty period. This shall apply to all items except those specifically excluded, or items wherein a longer period of service and warranty is specified or

indicated. All warranties shall be effective for one year, minimum, from date Certificate of Final Acceptance is issued. Use of systems provided under this section for temporary services and facilities shall not constitute final acceptance of work nor beneficial use by Owner and shall not institute warranty period. The warranty shall cover repair or replacement of defective materials, equipment, workmanship, and installation that may be incurred during this period. Warranty work is to be done promptly and to Owner's satisfaction. In addition, warranty shall cover correction of damage caused in making necessary repairs and replacements under warranty. Additional warranty responsibilities are:

1. Obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in Owner's designated name.Replace material and equipment that require excessive service during guarantee period as determined by Owner.
2. Provide 2-business day service beginning on date of Substantial Completion and lasting until termination of warranty period. Service shall be at no cost to Owner. Service can be provided by installing contractor or by a separate service organization. Choice of service organization shall be subject to Owner's approval. Submit name and a phone number that will be answered on a 24-hour basis each day of week, for duration of service.
3. Submit copies of equipment and material warranties to Owner before final acceptance.
4. At end of warranty period, transfer manufacturers' equipment and material warranties still in force to Owner.
5. If warranty work problems cannot be corrected immediately to Owner'ssatisfaction, advise Owner in writing, describing efforts to correct situation, and provide analysis of cause for problem. If necessary,to resolve a problem, provide at no cost services of manufacturer's engineering and technical staff at site in a timely manner to analyze warranty issues, and develop recommendations for correction, for review and approval by Owner.

C. **Owner's rights:**This section shall not be interpreted to limit Owner's rights under applicable codes and under this Contract.

D. **Pathways Material and Installation warranty:**Provide all services, materials and equipment necessary to warrant the installation and performance of all pathway materials for a period of one year after beneficial use. Scope of warranty includes all equipment, devices, installation and other work required to maintain a complete and operable system. Provide manufacturers published recommended preventative maintenance procedures during warranty period.

E. **Grounding and Bonding Material and Installation warranty:** Provide all services, materials and equipment necessary for successful operation of GBS for a period of one year after beneficial use. Scope of warranty includes all equipment, devices, installation and other work required to maintain a complete and operable system. Provide manufacturers published recommended preventative maintenance procedures during warranty period.

F. **Firestopping Material and Installation warranty:**Provide all services, materials and equipment necessary to warrant the performance of all Firestopping material for a period of one year after beneficial use, or longer if required by the local AHJ. Scope of warranty includes all equipment, devices, installation and other work required to maintain a complete and operable system. Provide manufacturers published recommended preventative maintenance procedures during warranty period.

27 02 65.20 SCS Manufacturers Extended Warranty

A. SCS Systems will be covered by a two-part certification program provided by a single manufacturer and that manufacturer's certified vendor. Manufacturer shall administer a follow-on program through the Vendor to provide support and service to the purchaser. The first part is an assurance program, which provides that the

certified system will support the applications for which it is designed, during the 25-year warranty of the certified system.

B. The second portion of the certification is a 25-year warranty provided by the manufacturer and the vendor on all products within the system (cords, telecommunications outlet/connectors, cables, cross-connects, patch panels, etc.).

C. In the event that the certified system ceases to support the certified application(s), whether at the time of cutover, during normal use or when upgrading, the manufacturer and vendor shall commit to promptly implement corrective action.

D. Documentation proving the cabling system's compliance to the End-to-End Link Performance recommendations, as listed in ANSITIA/EIA-568-B shall be provided by the Vendor prior to the structured cabling system being installed.

E. The cabling system must conform to the current issue of industry standard ANSI/TIA/EIA-568. All performance requirements of this document must be followed. As well, workmanship and installation methods used shall be equal to or better than that found in the BICSI (Building Industry Consulting Service International) ITSIM manual.

F. Purchaser demands strict adherence to the performance specifications listed in ANSI/TIA/EIA-568-B series standards.

G. Manufacturer shall maintain ISO Quality Control registration for the facilities that manufacturer the product used in this cabling system.

END of SECTION

27 10 00 Structured Cabling

27 10 10 General Requirements

A. Transmission performance of structured cabling varies with length, connecting hardware, cords and total number of connections. The installer must take care to properly install the cabling components. To ensure that the installed structured cabling solution meets or exceeds the required performance it must be 'tested' or 'certified'.

A. The requirements for each category of cabling (Cat6A) and optical fiber optics links are located in the ANSI/TIA-568 series standards.

B. Test equipment must meet the requirements set forth in the ANSI/TIA-568 series Standard for Field Test Equipment. All Copper testers shall be Level III. All fiber testers shall meet the requirements in ANSI/TIA-568.

C. Field Power Meters shall meet the following:

Accuracy ± 0.2 dB

Resolution 0.01 dB

Precision ± 0.15 dB

D. The Field light source shall meet the following:

Accuracy ± 0.01 dB

Wavelength 850 ± 30 nm

1300 ± 50 nm

1310 ± 30 nm

1550 ± 30 nm

E. The calibration on all test equipment shall be current.

F. The software in all test equipment shall be current.

27 10 10 Manufacturers

The following manufacturer's testers are approved.

A. FLUKE

1. Versiv
2. OptiFiber OTDR
3. DTX-CLT CertiFiber Optical Loss Test Set

B. Ideal

4. LanTEK II
5. LANTEK 6/6A/7G
6. FIBERTEK

C. Or another test equipment approved by the Owner

27 10 20 Systems Testing and Documentation

27 10 20.01 General Requirements

A. Provide installation testing of equipment where required by manufacturer's installation instructions.

B. Provide complete end to end testing for all copper and fiber optic systems/channels based on latest applicable standards. Document all testing and submit with final as-built submittal package.

C. For all controls and operating equipment, submit equipment/systems to at least three complete operational sequences, in which all equipment operations are tested, observed, and verified.

D. Prior to substantial completion and project acceptance inspection, submit test reports to indicated scope of startup and operational tests, with results of testing for each specified operation.

27 10 20.10 Copper Cabling System Testing

A. General: Copper cabling shall be tested and certified after installation as follows and as required for cable manufacturer's warranty. Twisted-pair copper cable channels shall be tested for continuity as specified below, presence of ac/dc voltage, and performance. All cabling shall be tested for conformance to horizontal cable specifications as outlined herein and shall be tested according to test set manufacturer's instructions utilizing latest firmware and software. Testing shall include all of electrical parameters as specified under Product. All cables and termination hardware shall be 100 percent tested by installation contractor for defects in installation and to verify cable performance under installed conditions. All conductors of each installed cable shall be verified useable by Contractor prior to system acceptance. All cables shall be tested according to contract documents, manufacturer's warranty provisions, and best industry practices. If any of these are in conflict, Contractor shall comply with most stringent requirements. All defects in cabling system installation shall be repaired or replaced in order to ensure 100 percent useable conductors in all cables installed, at no additional cost to Owner.

B. Continuity: Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. The test shall be recorded as pass/fail as indicated by test unit according to manufacturers' recommended procedures and referenced to appropriate cable identification number and circuit or pair number. Any faults in wiring shall be corrected and cable re-tested prior to final acceptance.

C. Length: Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to maximum distances set forth in TIA/EIA-568-D standards and all other applicable standards specified in Appendix 1: Codes, Standards, and Informative References. Cable lengths shall be recorded, referencing cable identification number and circuit or pair number. For multi-pair cables, shortest pair length shall be recorded as length for cable.

D. Factory testing: Every reel of cable shall be tested by cable manufacturer for all characteristics specified for cable type in this section. This testing shall be performed using a sweep test method and include frequencies specified for cable. A test report shall be available electronically, at no additional cost, for a minimum of five (5) years from the date of manufacture. The test report shall include the reel number, the date of the test, the Lot number, and test results for Return Loss (RL), Insertion Loss (Attenuation), Pair-to-Pair NEXT, and Power Sum NEXT Pair-to-Pair ELFEXT and Power Sum ELFEXT. The test report shall show the "Worst Case Margin" for the listed transmission characteristics.

E. Test results: Test results shall be automatically evaluated by equipment, using most up-to-date criteria from TIA/EIA-568-C standards and all other applicable standards

specified in Appendix 1: Codes, Standards, and Informative References, and result shown as pass/fail. Test results shall be printed directly from test unit or from a download file using an application from test equipment manufacturer. The printed test results shall include all tests performed, expected test result and actual test result achieved.

F. Test reports: Test reports for all factory testing and field test reports for copper cabling installation shall be submitted to the Owner's Representative and manufacturer prior to commissioning voice and data system and final contract payment. Refer to Submittals in this Section.

27 10 20.20 Optical Fiber Cable Testing

A. General: Optical fiber cabling shall be tested and certified after installation as described below and as required for cable manufacturer's warranty. Fiber testing shall be performed on all fibers in completed end to end system. Testing shall consist of a bi-directional end to end test in accordance with applicable standards in 27 02 20.20, or a bi-directional end to end test performed by EIA/TIA-455-53A and all other applicable standards in 27 02 20.20. The system loss measurements shall be provided at 850 and 1300 nanometers for multimode type glass and 1310 and 1550 nanometers for single-mode type glass. These tests shall also include continuity checking of each fiber. For spans greater than 90 meters, each tested span must test to a value less than or equal to value determined by calculating a link loss budget. For horizontal spans less than or equal to 90 meters, each tested span must be less than or equal to 2.0 decibels. The insertion loss for each mated optical fiber connector pair shall not exceed 0.40 decibels.

B. Pre-installation testing: Test all optical fiber cable for all fibers prior to installation of cable.

C. Performance testing: Where links are combined to complete a circuit between devices, Contractor shall test each link from end to end to ensure performance of system. Only a basic link test is required. Contractor can optionally install patch cords to complete circuit and then test entire channel. The test method shall be same used for test described above. The values for calculating loss shall be those defined in applicable TIA/EIA standards in Appendix 1: Codes, Standards, and Informative References.

D. Attenuation testing: Attenuation testing shall be performed with a stable launch condition using two-meter jumpers to attach test equipment to cable plant. The light source shall be left in place after calibration and power meter moved to far end to take measurements.

E. Loss budget: All fiber cabling shall be tested at both wavelengths 850 nm and 1310 nm for multimode and 1300 nm and 1550 nm for single mode.

1. The link attenuation shall be calculated using:
   a) The CommScope Fiber Performance Calculator for CommScope installations
   b) The following calculation for other installations:
      Link Attenuation Allowance (dB) = Cable Attenuation (dB) + Connector loss (dB) + Splice Insertion Loss (dB)
      Where:
      Cable attenuation (dB) = Cable attenuation (dB/km) X Length (km)
      Connector loss (dB) = Number of Connector pairs X Allowable connector loss (dB)
      Splice Insertion Loss (dB) = Number of Splices X Allowable Splice loss (dB)

F. Documentation: Following final documentation shall be submitted to the owner's representative prior to commissioning data system and final contract payment according to Submittals in this section.

G. Test results: Test results shall be automatically evaluated by equipment, using most up-to-date criteria from all applicable standards specified in 27 02 20.20 and result shown as pass/fail. Test results shall be printed directly from test unit or from a download file using an application from test equipment manufacturer. The printed test results shall include all tests performed, expected test result and actual test result achieved.

H. End to End Loss Data: final documentation shall be submitted to the owner's representative.

I. As Installed/ As Built Diagrams: Final documentation shall be submitted to the owner's representative.

27 10 20.30 Test Documentation

A. Electronic Format – if required

1. Certification Test Reports shall be submitted in electronic format using the appropriate software supplied by the test equipment manufacturer. The data format should be that of the test report software (i.e. *.flw files for Fluke). The contractor shall provide any necessary software to view and evaluate the test data.
2. The following list is provided as a reference:

Tester	Test Report Software
Fluke	LinkWare™
Ideal	LanTek® Reporter

3. One electronic copy of the Test Reports shall be provided.

B. Paper Format – if required

1. Provide test documentation in 3-ring binders within 2 weeks after completion of project testing. Binders shall be clearly marked on outside front cover and spine with words Test Results, project name, and date of completion (month and year). Major heading tabs, Horizontal and Backbone, shall divide binder. Each major heading shall be further sectioned by test type. Within horizontal and backbone sections, divide by tabs scanner test results by category, optical fiber attenuation test results, and continuity test results. Present test data within each section in sequence listed in administration records.
2. Provide test equipment by name, manufacturer, model number and last calibration date at the end of document. Unless manufacturer specifies more frequent calibration cycle, annual calibration cycle shall be required on all test equipment used for this installation.
3. Test document shall detail test method used and specific settings of equipment during test. Scanner tests shall be printed on 8 1/2 by 11 inches. Handwritten test results (attenuation results and continuity results) shall be documented on a suitable test form.
4. When repairs and re-tests are performed, note problem found and corrective action taken, and collocate in binder both failed and passed test data.

END OF SECTION

27 11 00 Communications Equipment Room Fittings

27 11 16 Communications Racks

1. GENERAL

1.1. Work Includes

A. Provide all labor, materials, and equipment for the complete installation of work called for in the Contract Documents.

1.2. Scope of Work

A. This section includes the minimum requirements for the equipment and cable installations in communications equipment rooms (Telecommunications Closets).

B. Included in this section are the minimum composition requirements and installation methods for the following:

Communication Racks and Rack Cable Management.

1.3. Quality Assurance

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

B. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

C. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:

ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard.
TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces.
ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
EIA-310-E, Cabinets, Racks, Panels, and Associated Equipment (most recent version).
NFPA 70 – National Electric Code.
BICSI – Telecommunications Distribution Methods Manual.

1.4. Submittals

A. Provide product data for the following:

B. Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

2. PRODUCTS

2.1. General

A. RACKS

1. ***The racks in this specification are basis of design. Specific details will provided in the construction drawings for part numbers and additional racks or enclosures not included in this specification.***
2. Racks shall be manufactured from aluminum extrusion.
3. Each rack will have two L-shaped top angles, two L-shaped base angles and two C-shaped equipment-mounting channels. The rack will assemble with nut and bolt hardware. The base angles will be pre-punched for attachment to the floor.
4. Equipment mounting channels will be punched on the front and rear flange with the EIA-310 Universal Mounting hole pattern.
   a. Aluminum Racks will be threaded with 12-24 roll-formed threads and will include 40 each combination pan head, pilot point mounting screws.
4. The rack will include assembly and equipment-mounting hardware.
5. The rack will be rated:
   a. Two Post Racks: 1,000 lb. (453.6 kg) of equipment
6. The rack will be UL Listed
7. When assembled with top and bottom angles, equipment-mounting channels will be spaced to allow attachment of 19” EIA rack-mount equipment.

B. RACK CABLE MANAGEMENT

1. Vertical cable management shall have doors that are lightweight, sturdy, and be available in different sizes to allow flexibility in design.
2. The cable management system shall have a C-Channel bracket that allows for easy access to the cable trough.
3. The vertical cable management system shall allow tool-less installation of Cable Spool.
4. Doors shall come standard with on all cable management and be available in both single- and double-sided configurations.
5. The door shall have dual hinge design that can be opened to the right or left.
6. The door latching mechanism shall have an easy closing feature.
7. The door shall have one-point removal and installation process for door.
8. Horizontal wire managers: The door shall have horizontal cover hinges up or down and be lockable into position with cylindrical finger ends for easy snap on installation
9. The door shall have a recessed handle to eliminate snag potential for clothes and arms.
10. The Horizontal cable management system shall have an open back on 2U and 3U horizontal troughs for easy pass-through of cables

2.2. Free Standing Two Post Aluminum Racks

A. 45U - 7ft (2134 mm) H x 3in (76 mm) Channel x 19in (482.6 mm) Equipment Rack

1. Rack is to provide 45 rack-mount spaces in a “7-foot rack” for equipment. Each mounting space will be marked and numbered on the mounting channel.
2. For the "7-foot rack" the assembled rack will measure 84" (2133.6 mm) high, 20.4" (518 mm) wide and 15" (381 mm) deep. The sides (webs) of the equipment-mounting channels will be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.

3. Finish shall epoxy-polyester hybrid powder coat in the color as specified below.
4. Approved Manufacturer: CommScope

RK3-45A (MID 760082479), Black

2.3. Free Standing Four Post Aluminum Racks

A. 45U - 7ft (2134 mm) H x 3in (76 mm) Channel x 19in (482.6 mm) Equipment Rack

1. Rack is to provide 45 rack-mount spaces in a “7-foot rack” for equipment. Each mounting space will be marked and numbered on the mounting channel.
2. For the "7-foot rack" the assembled rack will measure 84" (2133.6 mm) high, 20.4" (518 mm) wide and 29" (736.6 mm) deep. The sides (webs) of the equipment-mounting channels will be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.
3. Finish shall be epoxy-polyester hybrid powder coat in the color as specified below.

B. Approved Manufacturer: CommScope

RK4P45-29A (MID 760082529), Black

2.4. Wall mounted Racks.

A. 12U - Equipment Rack

1. Rack is to provide 12 rack-mount spaces for equipment. Each mounting space will be marked and numbered on the mounting channel.
2. Finish shall be epoxy-polyester hybrid powder coat in the color as specified below.

C. Approved Manufacturer: CommScope

1427519-1, Black

2.5. Vertical Cable Management for Racks

A. The vertical cable management kits are installed on the side of a 19-inch or 23-inch (483 or 584 mm) wide industry standard rack.

B. The door(s) shall be designed to provide a concealed vertical space for organizing patch cables.

C. Cable spools shall be used to organize longer patch cable lengths.

D. Cable managers are to be matched to the cable rack. Cable managers are available in 10-inch (254 mm) and 12-inch (305 mm) widths and in 7-foot (2.1 m) height.

E. Approved Manufacturer: CommScope

VCM-DS-84-10B (760089367) 10” Double Side, Vertical Cable Management, Black Door

VCM-DS-84-12B (760089375) 12” Double Side, Vertical Cable Management, Black Door

2.6. Horizontal Cable Management for Racks

A. The horizontal cable management kits are installed on a 19-inch (483 mm) wide industry standard rack above or below panels to organize patch cables.

B. The kits shall be available in a single-sided and double-sided configuration, and in a 2U- and 3U-height.

C. The units shall include covers that can be opened from the top, the bottom, or removed altogether.

D. The cover hinges shall be designed to hold the cover open from the top or bottom to facilitate faster cabling.

E. The 2U and 3U cable managers shall have a pass-through feature allowing access to and from the rear for additional cable routing.

F. The depth of the units shall be

1. Single-sided: 5-1/2 inches (140 mm) deep from front to back with the cover closed

G. Approved Manufacturer: CommScope

HTK-19-SS-3U (760072967) 3RU Horizontal Cable Management
HTK-19-SS-2U (760072959) 2RU Horizontal Cable Management

3. EXECUTION

3.1. Installation

A. Racks and Cable Management

1. Assemble racks and cable management according to manufacturer's instructions. Verify that equipment mounting rails are sized properly for rack-mount equipment before attaching the rack to the floor.
2. All racks must be attached to the floor in four places using appropriate floor mounting anchors. When placed over a raised floor, threaded rods should pass through the raised floor tile and be secured in the structural floor below.
3. Racks shall be grounded to the TGB using appropriate hardware provided by the contractor. The ground will meet local code requirements and will be approved by the Authority Having Jurisdiction (AHJ).
4. In seismic areas, the rack should have additional bracing as required by building codes and the recommendations of a licensed structural engineer.
5. Ladder rack may be attached to the top of the rack to deliver cables to the rack. The rack should not be drilled to attach ladder rack. Use appropriate hardware from the ladder rack manufacturer.
6. The equipment load should be evenly distributed and uniform on the rack. Place large and heavy equipment towards the bottom of the rack. Secure all equipment to the rack with equipment mounting screws.

END of SECTION

27 11 19 Communications Termination Blocks and Patch Panels

1. GENERAL

1.1. Work Includes

A. Provide all labor, materials, and equipment for the complete installation of work called for in the Contract Documents.

1.2. Scope of Work

A. This section includes the minimum requirements for Horizontal and Backbone cable terminations installed in communications equipment rooms (Telecommunications Rooms, Equipment Rooms, or "Telecommunications Closets").

B. Included in this section are the minimum composition requirements and installation methods for the following:

Patch Panels

1.3. Quality Assurance

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

B. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

C. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:

ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,
TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,
ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
NFPA 70 – National Electric Code
ISO/IEC 11801 - Generic cabling for customer premises
CENELEC EN-50173 - Generic cabling systems
BICSI – Telecommunications Distribution Methods Manual

1.4. Submittals

A. Provide product data for the following:

Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1. PRODUCTS

1.1. Patch Panels

A. Modular Patch Panels. ***CALCULATE PATCH PANELS TO LEAVE 15% SPACE FOR FUTURE GROWTH.***

1. General specifications: Patch panel shall be constructed of high strength steel with black powder finish and designed for wall or 19-inch rack mounting.
2. Panels shall be available in 24-port (1U) and 48-port (2U) configurations.
3. Panel shall be designed for use with CommScope Category 6 and 6A Information Outlets (ordered separately).
4. Removable rear mounted cable management bar and front and rear identification labels.
5. Approved Manufacturer:CommScope

CPP-UDDM-M-1U-24 (760207274) 24-port modular flat panel - 1U

CPP-UDDM-M-2U-48 (760207282) 48-port modular flat panel - 2U

A. Fiber Optic Shelf Panels

1. General specifications: Shelves shall be constructed of high strength steel with black powder finish and designed for wall or 19-inch rack mounting.
2. Shelves shall be available in multi U configurations, with height of 1 Rack Unit (RU) 44.5 mm (1.75 in), to 4 RU 177.8 mm (7 in).
3. Removable rear mounted cable management door or cover and front and rear identification labels.
4. Comply with the standards for patch panels listed in the TIA/EIA-568 Series Standards and ISO/IEC 11801.
5. Fiber Shelf Panels shall accept ST, SC or LC modular adapter panels.
6. Approved Manufacturer 1U shelves:CommScope

SD-1U (760231449) 1U Sliding Adapter Panel Shelf

7. Approved Manufacturer 2U shelves: CommScope

SD-2U (760231456) 2U Sliding Adapter Panel Shelf

8. Approved Manufacturer 4U shelves: CommScope

SD-4U (760231464) 4U Sliding Adapter Panel Shelf

2. EXECUTION

2.1. Installation

A. All Patch Panels shall be installed in the racks installed in the telecommunications space.

B. Each patch panel shall be attached to the rack using the four (4) rack screws supplied with the panel

C. All Patch Panels shall be installed level and plum within the racks.

D. Patch Panels shall be installed per the elevation drawings for the Telecommunications space.

END of SECTION

27 11 23 Communications Cable Management and Ladder Rack/Tray

1. GENERAL

1.1. Work Includes

Provide all labor, materials, and equipment for the complete installation of work called for in the contract documents.

1.2. Scope of Work

A. This section includes the minimum requirements for the equipment and cable installations in telecommunications rooms.

B. Included in this section are the minimum composition requirements and installation methods for the following:

Ladder Rack/Tray

1.3. Quality Assurance

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the owner or owner representative.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated or a substitution is requested, equipment shall be equivalent in every way to that of the equipment specified. All substitutions are subject to the control and approval of the owner or the owner representative.

C. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

D. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:

ANSI/TIA – 568 Series
TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces
ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
NFPA 70 – National Electric Code
BICSI – Telecommunications Distribution Methods Manual
NEMA – VE-1 – Metal Cable Tray Systems
NEMA – VE-2 – Metal Cable Tray Installation Guidelines

1.4. Submittals

Provide product data for the following:
Manufacturers data/cut sheets, product drawing/specifications and installation instructions for all products (submit with bid).

2. PRODUCTS

2.1. Ladder Rack/Tray, Supports, And Accessories

A. Ladder Rack / Tray

1. Ladder rack/tray shall be manufactured from tubular steel. Stringers (sides) will be made from 3/8" wide by 1-1/2" high tubular steel with .065" wall thickness. Cross members (rungs) will be made from 1" wide by ½" high tubular steel with .065" wall thickness.
2. Ladder rack/tray cross members will be welded in between stringers on 9" centers. There will be 8" of open space in between each cross member.
3. Design Make:
   CommScope example part numbers

CR-SLR-10L12W(760085647)10ft long, 12" wide, Black

CR-SLR-10L18W (760085654)10ft long, 18" wide, Black

CR-SLR-10L24W(760085662) 10ft long, 24" wide, Black

B. Horizontal 90° Turns (Cable Runway E-Bend)

1. Horizontal 90° turns shall be manufactured from 3/8" wide by 1-1/2" high tubular steel with .065" wall thickness.
2. Stringers (sides) will be formed in a 90° arc. Cross members will be welded in between stringers on approximate 23° increments so that there are 5 cross members per turn. The welded assembly will have an inside radius that will create a smooth horizontal 90° turn.
3. Design Make:
   CommScope example part numbers

CR90FCB-12W (760085530) 12 inch (305 mm) W

CR90FCB-18W (760085548) 18 inch (457 mm) W

CR90FCB-24W (760085555) 24 inch (610 mm) W

C. Ladder Rack/Tray Splices

1. Splice kits will provide a method of mechanically connecting ladder rack/tray sections and turns together end-to-end or side-to-end to form a continuous pathway for cables.
2. Design Make:
   CommScope example part numbers

CRBSK (760083899) Butt Splice Kit

CRTJSK (760084046) Junction Splice Kit

D. Ladder Rack/Tray Accessories

1. Cable straps used for attaching cable bundles to the ladder rack/tray cross members must be reusable with a hook and loop-style closure, at least ¾" wide, and sized for cable bundles that are 2", 3" or 4" in diameter.
2. Cable retaining posts used to keep cable from falling off of the side of the ladder rack/tray shall be manufactured from 1" by ½" tubular steel with .065" wall thickness. Cable retaining posts will be 8" high and will attach to the side stringer of the ladder rack/tray with included hardware. The top of the cable retaining posts will be fitted with a rubberized end cap to protect cables.
3. End caps used to cover the ends of ladder rack/tray will be manufactured from a black fire-retardant rubberized material. End caps will be sized for 3/8" wide by 1-1/2" high side stingers and will be sold in pairs.

4. Radius drops or “waterfalls” used to maintain the bend Radius of the cables as they exit or enter the ladder rack/tray will be manufactured from aluminum extrusion. The extrusion will be formed in a 90° arc with a minimum bend radius of 3”. Radius drops will attach to either the side stringer or the cross member of the ladder rack/tray using a clevis pin. Radius drops will include 1-1/2” high cable spools that attach to the top of the radius drop to guide cables.
5. Auxiliary support brackets used to support cables that should be physically separated from the cables in the ladder rack/tray will be made from 1/8” x 1” steel bar. The bracket will be L-shaped and will attach to the side stringer of the ladder rack/tray. The bracket will hang below the ladder rack/tray a minimum of 4”. The bracket support surface will be 4” long. The bracket will be zinc plated with a gold chem. finish.
6. Unless otherwise noted, finish on all metal components shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below. Hardware will be zinc plated with a gold chem. finish.
7. Design Make:
   CommScope example part numbers

CRRP-8H (760083980) Cable retaining posts

CRPECK (760084012) Ladder rack end caps

CRDK-12W (760083956) Radius Drops

3. EXECUTION

3.1. Installation

A. Provide all components of the ladder rack/tray system (ladder rack/tray, turns, splices, supports, and accessories) from a single manufacturer.

B. Ladder rack/tray shall be installed with side stringers facing down so that the ladder forms an inverted U-shape and so that welds between the stringers (sides) and cross members (middle) face away from cables.

C. Ladder rack/tray shall be secured to the structural ceiling, building truss system, wall, floor or the tops of equipment racks and/or cabinets using the manufacturer’s recommended supports and appropriate installation hardware and methods as defined by local code or the authority having jurisdiction (AHJ).

D. Ladder rack/tray splices will be made in mid-span, not over a support, with the manufacturer’s recommended splice hardware.

E. Ladder rack/tray shall be supported every 5’ or less in accordance with TIA-569. Ladder rack/tray shall be supported within 2’ of every splice and within 2’ on both/all sides of every intersection. Support ladder rack/tray within 2’ on both sides of every change in elevation. Support ladder rack/tray every 2’ when attached vertically to a wall.

F. When the pathway is overhead, ladder rack/tray shall be installed with a minimum clearance of 12” above the ladder rack/tray. Leave a minimum of 12” in between ladder rack/tray and ceiling/building truss structure. Leave a minimum of 3” in between ladder rack/tray and the tops of equipment racks and/or cabinets. Multiple tiers of ladder rack/tray shall be installed with a minimum clearance of 12” in between each tier of ladder rack/tray. When located above an acoustical drop ceiling, leave a minimum of 3” clearance between the top of the drop ceiling tiles and the bottom of the ladder rack/tray.

G. All threaded rod used in support of overhead cable trays shall have cable guard protectors installed over the exposed threaded rod in the area of the tray. The

exposed end of the threaded rod hangers shall be cut flush with the mounting brackets, filed, and painted to match site conditions. Install rubber finishing caps on any exposed metal end rail or potential sharp point.

H. When installed under a raised floor, ladder rack/tray shall be installed with a minimum 3" clearance between the top of the ladder rack/tray and the bottom of the floor tiles or floor system stringers, whichever is lower in elevation. Maintain a 3" clearance between ladder racks/trays wherever ladder racks/trays cross.

I. Within each telecommunications room, ladder rack/tray should be bonded together, electrically continuous, and bonded to the TGB, unless otherwise noted in the specifications and contract documents. Ladder rack/tray and turns shall be bonded across each splice with a bonding kit. Ladder rack/tray shall be bonded to the Telecommunications Grounding Busbar (TGB) using an approved ground lug on the ladder rack/tray and a minimum #6 grounding wire or as recommended by the AHJ. Remove paint from the ladder rack/tray where bonding/ground lugs contact the ladder rack/tray so that the lug will contact bare metal. Use antioxidant joint compound in between the bare metal on the ladder rack/tray and ground lug. Use antioxidant joint compound in between the bus bar and the ground lug. Verify continuity through the bonds at splices and intersections between individual ladder rack/tray sections and turns and through the bond to the TGB.

J. The quantity of cables within the ladder rack/tray will not exceed a whole number value equal to 50% of the interior area of the ladder rack/tray divided by the cross-sectional area of the cable. The interior area of ladder rack/tray will be considered to be the width of the ladder rack/tray multiplied by a height of 2", unless cable retaining posts are added to the ladder rack/tray. The interior area of ladder rack/tray equipped with cable retaining posts will be considered to be the width of the ladder rack/tray multiplied by a height of 6". Actual cable fill for ladder rack/tray that is not equipped with cable retaining posts will not exceed 2" in height. Actual cable fill for ladder rack/tray equipped with cable retaining posts will not exceed 6" in height.

K. The combined weight of cables within the ladder rack/tray will not exceed the stated load capacity of the ladder rack/tray as stated in the manufacturer's product specifications or load/design tables.

L. Cables (cable bundles) will be secured to the cross members of ladder rack/tray with ¾" wide reusable straps. Straps are not required when ladder rack/tray is equipped with cable retaining posts.

M. Use a radius drop to guide cables wherever cable exits overhead ladder rack/tray to access a rack, cabinet or wall-mounted rack, and cabinet or termination field. Provide a support for conductors that should be physically separated from cables within the ladder rack/tray as defined by local code or the authority having jurisdiction (AHJ).

N. Whenever possible, maintain a 2' separation between ladder rack/tray used for communications cables and pathways for other utilities or building services.

O. The installer will provide touch-up paint color-matched to the finish on the ladder rack/tray and will correct any minor cosmetic damage (chips, small scratches, etc.) resulting from normal handling during the installation process prior to delivery to the owner. If a component is cosmetically damaged to the extent that correction in the field is obvious against the factory finish, the component will be replaced with a new component finished from the factory. If a component is physically damaged due to mishandling or modification during the installation process, it shall not be used as part of the ladder rack/tray system.

END of SECTION

27 13 00 Communications Backbone Cabling

27 13 23 Communication Optical Fiber Backbone Cabling

1. GENERAL

1.1. Work Includes

Provide all labor, materials, and equipment for the complete installation of all Optical Fiber Backbone Cables called for in the Contract Documents.

1.2. Scope of Work

A. This section includes the minimum requirements for Optical Fiber Backbone Cables.**PART NUMBERS PROVIDED ARE JUST FOR REFERENCE. CHECK PROJECT DRAWINGS FOR EXACT FIBER COUNT AND TYPE. CHECK WITH OWNER THE CONNECTOR TYPE AND MOUNTING PREFERENCE (RACK OR WALL) TO BE USED BEFORE PROCURING MATERIAL**

B. Included in this section are the minimum composition requirements and installation methods for the following:

1. Inter Building Backbone (Between buildings (OSP))
2. Intra Building Backbone (Inside buildings (ISP/OSP))
3. Inter Building Backbone (Inside Buildings (ISP))

1.3. General Specifications

A. Cables shall be designed for Point to Point applications and shall provide a high level of protection for optical fiber installed in building applications.

B. Higher optical fiber count cables shall utilize a sub-unitized design with color-coded subunits for easy identification.

1.4. Cable Performance Specifications

Cables shall comply with the applicable standards per cable type:
Bellcore, fiber distributed data interface (FDDI), and EIA standards
ANSI/ICEA S-87-640, Standard for Optical Fiber Outside Plant Communications Cable
Telcordia, GR-20-CORE, Generic Requirements for Optical Fiber and Optical Fiber Cable
Telcordia, GR-409-CORE, Generic Requirements for Indoor Fiber Optic Cables
Telcordia requirements for superior armored cable
TIA/EIA-568-C .1
TIA/EIA-568-C.3
ISO/IEC 11801
CENELEC EN-50173
EN 187105

1.5. General - Multimode Fiber (IF NEEDED)

A. Cable shall support current and next generation LAN, SAN, and WAN applications through laser-optimized 50/125 micrometer optical fibers and shall extend distance of low-cost 850 nanometer vertical cavity surface-emitting laser (VCSEL) based electronics

B. Cable shall support dual speed 1 gigabit per second/10 gigabits per second ports, allowing incremental upgrades of switches and servers with less disruption

C. Optical fibers shall be differential mode delay (DMD) tested using a high-resolution test bench that exceeds fiber optic test procedure (FOTP) 220 standards and independently certified by UL.

D. Cable shall also support existing and legacy multi-mode applications that traditionally operate in 850 and 1300 nanometer regions.

1.6. OM4 Multimode Fiber Specification

A. The multimode fibers shall fully meet or exceed the OM4 fiber specifications in:

EN 50173-1:2011
ISO/IEC 11801:2010
IEC/EN 60793-2-10 (A1a fiber)
ANSI/TIA-492AAAD standards
Local/National Codes and Regulations

B. The OM4 multimode fiber shall be manufactured with an inside vapor deposition process such as the MCVD (Modified Chemical Vapor Deposition) or PCVD (Plasma Clad Vapor Deposition) processes. Multimode fibers produced with outside vapor deposition processes, such as OVD or VAD, will not be accepted. Inside vapor deposition manufacturing processes results in superior control of Refractive Index Profile required for high bandwidth.

C. The OM4 Multimode Fiber SCS shall be capable of supporting, at minimum, the following IEEE Ethernet applications:

802.3j	10BASE-F 10 Mb/s
802.3j	10BASE-FL 10 Mb/s
802.3u	100BASE-FX 100 Mb/s
802.3u	100BASE-SX 100 Mb/s
802.3z	1000BASE-SX 1000 Mb/s
802.3ae	10GBASE-SR 10Gb/s
802.3aq	10GBASE-LRM 10Gb/s with EDC
802.3ba	40GBASE-SR4 40 Gb/s
802.3ba	100GBASE-SR10 100 Gb/s

D. Additionally, the OM4 Multimode Fiber SCS shall be capable of supporting the following Fiber Channel Applications Standards, per Technical Committee 11 of INCITS:

1GFC
2GFC
4GFC
8GFC
10GFC
16GFC

E. The OM4 multimode fiber shall comply with the following physical specifications:

Cladding Diameter	125 µm
Cladding Diameter Tolerance	±1.0 µm
Cladding NonCircularity, maximum	1%
Coating Diameter (Colored)	254 µm
Coating Diameter (Uncolored)	245 µm
Coating Diameter Tolerance (Colored)	±7 µm
Coating Diameter Tolerance (Uncolored)	±10 µm
Coating/Cladding Concentricity Error, maximum	6 µm
Core Diameter	50.0 µm
Core Diameter Tolerance	±2.5 µm
Core/Clad Offset, maximum	1.5 µm
Numerical Aperture	0.200 ± 0.015
Zero dispersion wavelength	1297 – 1316 nm
Zero dispersion slope	≤ 0.105 ps/nm2-km
Maximum DMD (note: must comply with at least one of the 6 templates specified below 850 nm 1300 nm	Meets or exceeds TIA/EIA-492AAAC-A and IEC 60793-2-10 A1a.2 See attached templates 0.88 ps/m

F. The OM4 multimode fiber shall meet the following requirements:

Maximum Fiber **Cabled** Loss	3.0 dB/km at 850 nm* 1.0 dB/km at 1300 nm*
Minimum Effective Modal Bandwidth Minimum overfilled Modal Bandwidth	4700 MHz.km at 850 nm (DMD, laser) 500 MHz.km at 1300 nm (DMD, laser) 3500 MHz.km at 850 nm (OFL) 500 MHz.km at 1300 nm (OFL)
Operating Temperature Range (cabled fiber)	-20°C to 50°C (-4°F to 122°F)*
Storage Temperature Range (cabled fiber)	0°C to 50°C (32°F to 122°F) for LSZH -40°C to 65°C (-40°F to 149°F) for others
Maximum Pulling Tension	90 kg
Minimum Tensile Strength	0.7 GPa (100,000 psi)

* NOTE: this value reflects cabled fiber loss. Un-cabled fiber values will not be accepted

G. The OM4 multimode fibers shall be color coded to facilitate individual fiber identification. Color coding shall follow industry standard TIA-598-C Optical Fiber Cable Color Coding

H. The coating shall be mechanically strippable.

I. The OM4 fiber shall meet a minimum of one of the DMD templates listed below, accounting for the wider inner and outer mask specifications when compared with TIA 492AAAc and IEC 60793-2-10 standards:

J. Differential Mode Delay Testing

The OM4 multimode fiber shall be tested in accordance with:

IEC/EN 60793-1-49
ANSI/TIA-455-220-A
ANSI/TIA-492AAAC-A

K. The following additional enhancements to the DMD tests must be made to ensure high bandwidth:

Enhancement to IEC/EN 60793-1-49 and ANSI/TIA-492AAAC-A standards	
Parameters	**Test Requirement**
Speed of Laser	5 ps pulse width
Scan Resolution (Radial Increment)	1 µm
Inner Mask Radial Coverage	0 – 18 µm (no central hole)
Number of Quadrants Tested	4 quadrants
Test Length	300- 550 meters

L. The Cable Manufacturer must have the capability to test DMD for cabled product. Third party verification of the DMD test bench must be provided with the bid response.

2. PRODUCTS

2.1. Inter Building Stranded Backbone (OSP)

A. All cable shall be manufactured and constructed for use in the Outside Plant Environment and shall meet one of the following, per bid document.

1. Outside Plant (OSP) loose tube all dielectric - Dielectric design with MDPE sheath jacket and no metallic elements to provide environmental protection.
2. Outside Plant (OSP) loose tube metallic sheath - Metallic sheath design with MDPE sheath jacket to provide environmental protection. Metallic armor of corrugated polymer coated steel tape to provide added crush protection. Armor shall meet Telcordia requirements for superior armored cable.

B. Buffer tubes and optical fibers

1. Industry standard buffer tubes stranded around a central strength member and compatible with standard hardware, cable routing, and fan-out kits.
2. Optical fibers shall be industry-standard color coded and separated into 12-fiber color-coded binder groups surrounded by plastic core tubes

C. Water blocking

1. OSP Fiber Cables utilize dry water-blocking compound suitable for underground conduit, direct burial, and aerial applications in cable and buffer tubes.

2.2. Intra Building Backbone Indoor/outdoor(ISP/OSP)

A. Indoor/OutdoorCables - All cable shall be manufactured and constructed for use in the Outside Plant Environment and listed for use indoors per the National Electrical Code (NFPA-70) and shall meet both of the following, per bid document.

1. **Indoor Plenum Rated Tight Buffered Cable**UL-listed OFNP cable: Tight buffer optical fibers, aramid strength yarn, and plenum-rated outer jacket.
2. **Indoor Armored Plenum Rated Tight Buffered Cable**UL-listed OFCP cable: Tight buffer optical fibers, aramid strength yarn, a plenum-rated outer jacket, aluminum

2.3. Inter Building Backbone Indoor (ISP)

B. Indoor - All cable shall be listed for use indoors per the National Electrical Code (NFPA-70) and shall meet both of the following, per bid document.

1. **Indoor Plenum Rated Tight Buffered Cable** UL-listed OFNP cable: Tight buffer optical fibers, aramid strength yarn, and plenum-rated outer jacket.
2. **Indoor Armored Plenum Rated Tight Buffered Cable** UL-listed OFCP cable: Tight buffer optical fibers, aramid strength yarn, a plenum-rated outer jacket, aluminum

2.4. Approved Manufacturer

A. **Basis for Design Specifications: For Singlemode fiber use Commscope OS2 and Commscope OM4 LazrSPEED multimode optical fiber unless otherwise noted, in strand-count identified on Telecommunications Drawing and/or the Bid Document, and with the appropriate jacket material [OFNP or OFCP] for the pathway in which the cable will be routed.**

1. Approved Manufacturer: CommScope
Example Catalog/Manufacturer Part Number: (other fiber counts available)

D-024-LN-5K-F12NS (760054296) 24-fiber All-Dielectric, Gel-Free, Outdoor Stranded Loose Tube Cable

D-024-LA-5K-F12NS (760053744) 24-fiber Armored, Gel-Free, Outdoor Stranded Loose Tube Cable

P-024-OD-5K-FSUBK (760037457) 24-fiber Indoor/Outdoor Plenum Distribution Cable

P-024-OZ-5K-FSUBK (760037457) 24-fiber Indoor/Outdoor Plenum Distribution Cable, interlocking aluminum armor

P-024-DS-5K-FSUAQ (760018697) 24-fiber Indoor Plenum Distribution Cable

P-024-DZ-5K-FSUAQ (760127910) 24-fiber Indoor Plenum Distribution Cable, interlocking aluminum armor

3. EXECUTION

3.1. Installation

A. General - Inter and Intra Building Fiber Backbone Cable.

1. Contractor shall comply applicable codes, standards and with all local codes and requirements. It is the responsibility of the contractor to identify and adhere to any unique codes or requirements governed by the region where the work is to be performed.

2. Provide all necessary products for installation of Fiber Backbone cablings to include cable attachments, etc.
3. Backbone cable shall be installed following industry standard practices.
4. Contractor shall not exceed the maximum pulling tension or the minimum bending radius for fiber cables per manufacturer's specifications.
5. All installations shall comply with:
   ANSI/TIA/EIA – 568 Series Commercial Building Telecommunications Cabling Standard,
   TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,
   ANSI/TIA/EIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
   ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
   NFPA 70 – National Electric Code.
   BICSI – Telecommunications Distribution Methods Manual.

B. Backbone Cable Testing.

1. Complete end-to-end test results for all Fiber Optic cables installed are required.
2. All fiber optic cable must be visually inspected and optically tested on the reel upon delivery to the installation site. Using an Optical Time Domain Reflectometer (OTDR), an access jumper with like fiber, a pigtail, and a mechanical splice, all fibers shall be tested for continuity and attenuation.
3. Testing for continuity and attenuation on the reel must confirm factory specifications to ensure that the fiber optic cable was not damaged during shipment. The test results must match the results of the factory-attached tag on the reel, or the fiber shall not be used. Reel data sheet must be provided showing test results.
4. End to end test measurements shall be provided for multimode fibers (2 wavelengths per test are required). Test results must be submitted for review as part of the installation inspection requirements. Test results shall be in paper form and electronic form and must contain the names and signatures of the technicians performing the tests.
5. Testing shall be performed on 100% of the fibers in the completed end-to-end system. ANSI/TIA-568-A, Annex H, provides the technical criteria and formulae to be used in fiber optic testing. Note however, that all UH fiber must be tested, rated and guaranteed for Ethernet GigaSPEED 1000B-X performance.
6. Additionally, all fiber optic cable links must pass all installation and performance tests both recommended and mandated by the cable manufacturer.
7. The Owner is to be notified at least 24 hours prior to testing to allow observation at the Owner's discretion. If the Owner confirms his intention to observe, a reasonable starting time shall be agreed upon. Should the Owner not be present at the scheduled commencement time, the Contractor may begin testing as scheduled.
8. Testing Format: Test Results must be submitted in two (2) formats. First, must be original file(s) downloaded from tester. Second, the file must be cohesively placed in Excel format with the following fields:
   ER/TR RM # / RM # of drop / Port # / all relevant test information in as many fields as necessary.
9. All test results are to be recorded and submitted to the Owner.

C. Cable and Termination Panel Labeling.

Label the installed cables according to the label scheme required by the owner with a permanent computer-generated label.

D. Cable Support.

1. Provide cable supports and clamps to attach cables to backboards and walls.
2. Attach horizontal and vertical backbone cables at 4 to 5 foot intervals using Owner approved supports; such as D-rings or jumper troughs utilized for wire management.
3. Attach cables to manhole racks using Owner approved methods
4. Backbone cabling shall be secured to the cable/ladder tray following manufacturer recommended procedures, and appropriate installation hardware and methods as defined by local code or the authority having jurisdiction (AHJ).

E. As-built Drawings

1. CAD Files: Provide CAD files in .dwg or .dgn formats showing floor plans with room numbers and actual backbone cabling and pathway locations and labeling. The deliverable is required within 5 business days of final cable testing.
2. Red Line Drawings: Contractor must keep one (1) E size set of floor plans on site during work hours showing installation progress marked and backbone cable labels noted. Contractor may be asked to produce these drawings for examination during construction meetings or field inspections.

END of SECTION

27 15 00 Communications Horizontal Cabling

27 15 13 Communication Copper Horizontal Cabling

1. GENERAL

1.1. Work Includes

Provide all labor, materials, and equipment for the complete installation of all Copper Horizontal Cabling applications called for in the Bid Documents. **THE CABLING FOR HORIZONTAL APPLICATIONS SHOULD BE PLENUM RATED OR OSP RATED DEPENDING ON THE LOCATION, CATEGORY 6A. THE JACKET COLOR WILL BE COLOR CODED PER APPLICATION: BLUE FOR DATA, YELLOW FOR ACCESS POINTS AND WHITE FOR CAMERAS. THE JACK COLORS AT THE WORK STATIONS AND PATCH PANELS AND THE PATCH CABLES SHOULD MATCH THE CABLE JACKET COLOR.**

1.2. Scope of Work

A. This section includes the minimum requirements for Copper Horizontal Cables.

B. Horizontal cable to Workstations shall consist of Category 6Acopper cable for all Data and Voice applications.

1. Horizontal cabling to typical workstation (including offices, cubicles and conference rooms) shall consist of four Category 6Acables.See plans for actual counts.

2. Optionally, Owner may specify placing two Category 6A cables to each work station. See plans for actual counts.

C. Horizontal cable to Wireless Access Points (WAP) shall consist of Category 6A copper cable.

1. Cabling to typical WAP shall consist of two Category 6A cable.

D. Faceplates for wall-mounted or other “telephone only” installations shall consist of one Category 6 cable.

E. **Wet Location Requirement:** In the event that horizontal cabling is routed through conduit, consideration shall be given to the pathway to determine if the cabling must be rated for a wet environment. Per the BICSI Telecommunications Distribution Methods Manual, slab-on-grade construction where pathways are installed underground or in concrete slabs in direct contact with soil (e.g., sand and gravel) is considered a wet location.

1. For Category 6 or 6A cabling, an OSP rated product must be used in wet locations.

2. It may also be necessary to include a transition point in the permanent link cabling to meet the plenum safety rating at the exit of the wet location.

1.3. Quality Assurance

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

B. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

C. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:

ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,
TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,
ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
NFPA 70 – National Electric Code
BICSI – Telecommunications Distribution Methods Manual
TIA/EIA-568-C.1 – Commercial Building Telecommunications Cabling Standard
TIA/EIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards
ISO/IEC 11801 - Generic Cabling for Customer Premises
CENELEC EN-50173 - Generic Cabling Systems

1.4. Cable Construction (by Type):

A. Listed CMP cable: Solid copper conductors with fluorinated ethylene propylene (FEP) insulation and an overall low smoke PVC jacket to achieve plenum rating by applicable NEC requirements.

B. OSP outdoor cable rated for wet locations: Solid copper conductors with polyethylene insulation, polyolefin fluted center member with flooding compound, and black polyethylene jacket

C. Comply with following general physical specifications:

1. Maximum pulling tension: 110 Newton’s (25 pound-force)
2. Operating temperature: –20 to 60 degrees C [–4 to 140 degrees F]

1.5. Submittals

Provide product data for the following:
Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1.6. Coordination

Coordinate layout and installation of cable tray with other trades.

2. PRODUCTS

2.1. Data Communications Horizontal Cabling Category 6A

A. Category 6A/Class E Unshielded Twisted-Pair (UTP) Cable

1. All Cables shall be of round construction
2. Each cable shall contain 4 color coded pairs
3. Cable shall be listed for the environment where it will be installed (Plenum or OSP)

4. Approved Manufacturer: CommScope

CS44P YEL C6A 4/23 U/UTP CPK 1KFT (UN874050014/10) 4-pair Category 6A U/UTP Cable, plenum, blue jacket

CS34O BLK C6 4/24 U/UTP RL 1KFT (UN884019904/10) 4-pair Category 6 U/UTP filled Cable, outdoor direct burial, black jacket

A. Category 6A horizontal cabling shall provide the following Margin to the specification when installed in a 4 connector Channel.

Electrical Parameter (1-250MHZ)	Guaranteed Channel Margins to Amendment 1 to ISO/IEC 11801:2002 "Class E_A"
Insertion loss	3%
NEXT	1 dB
PSNEXT	2.5 dB
ACR-F	6 dB
PSACR-F	8 dB
Return Loss	>0 dB

B. Category 6A horizontal cabling shall meet or exceed the performance specifications listed in the following table when installed in a 4 connector Channel.

Guaranteed Channel Performance Specifications for 4-Connection Ultra 10 U/UTP Systems

Freq (MHz)	Insertion Loss (dB)	PS ANEXT (dB)	Avg. PS ANEXT (dB)	PS AACR-F (dB)	AVG. PS AACR-F (dB)	NEXT (dB)	ACR-N (dB)	PSNEXT (dB)	PSACR-N (dB)	ACR-F (dB)	PSACR-F (dB)	Return Loss (dB)
100	20.3	60.0	62.3	37.0	41.0	45.9	25.6	44.6	24.3	29.3	28.3	15.0
200	29.2	55.5	57.8	31.0	35.0	40.8	11.6	39.4	10.2	23.2	22.2	12.0
250	32.9	54.0	56.3	29.0	33.0	39.1	6.2	37.7	4.8	21.3	20.3	11.0
300	36.2	52.8	55.1	27.5	31.5	32.7	-3.5	31.3	-4.9	20.0	19.0	7.2
400	42.3	51.0	53.3	25.0	29.0	30.6	-11.7	29.1	-13.2	17.5	16.5	6.0
500	47.8	49.5	51.8	23.0	27.0	28.9	-18.9	27.3	-20.5	15.5	14.5	6.0

1. The table provides reference values only. All parameters comply with the governing equations over the entire frequency range.
2. All values and equations apply to worst-case channels utilizing four-pair 10G4 series cables with full cross-connects, consolidation points and work area outlets (4 connections in a channel) for the length up to 100 meters.

3. PART3 – EXECUTION

3.1. Installation

A. Contractor shall comply applicable codes, standards and with all local codes and requirements. It is the responsibility of the contractor to identify and adhere to any unique codes or requirements governed by the region where the work is to be performed.

B. Cable shall be installed following industry standard practices.

C. Horizontal cabling shall be installed from the work area outlet location to the nearest Telecommunications Space.

D. Horizontal cabling shall be terminated on a patch panel in the telecommunication space which is the same category rating as the Cable. i.e. Cat 6 cable terminates on Cat 6 panels.

E. Contractor shall not exceed the maximum pulling tension or the minimum bending radius for twisted pair cables per manufacturer's specifications.

F. Contractor shall test all horizontal links per the ANSI/TIA-568 Requirements.

END of SECTION

27 15 43 Communications Faceplates and Connectors

27 15 43.10 Communications Copper Jack/Information Outlets, Connectors and Transition Points

1. GENERAL

1.1. Work Includes

Provide all labor, materials, and equipment for the complete installation of all Jack/Information outlets and connections called for in the Bid Documents.

1.2. Scope of Work

A. This section includes the minimum requirements for Jack/Information outlets and Connectors.

B. The channel performance for the installation shall meet or exceed the requirements of ANSI/TIA-568 and ISO/IEC 11801 for the specified Category.

C. The Jack/Information outlets shall match the category of the cabling

D. All jacks/information outlets shall meet UL 94 V-O

1.3. Quality Assurance

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

C. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

D. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:

ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,
TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,
ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
NFPA 70 – National Electric Code
BICSI – Telecommunications Distribution Methods Manual
Bellcore, fiber distributed data interface (FDDI), and EIA standards
ANSI/ICEA S-87-640, Standard for Optical Fiber Outside Plant Communications Cable
Telcordia's Generic Requirements for Optical Fiber and Optical Fiber Cable
TIA/EIA-568-C .1
TIA/EIA-568-C.2
TIA/EIA-568-C.3

ISO/IEC 11801
CENELEC EN-50173

1.4. Submittals

Provide product data for the following:
Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1.5. Coordination

Coordinate installation of Jack/Information outlets and connectors with other trades.

2. PRODUCTS

2.1. General

A. All products will be compliant to RoHS 2002/95/EC

B. All products will be designed, manufactured and/or distributed under this quality management system: ISO 9001:2008

C. Telecommunications jacks shall be 8-position/8-conductor modular outlets accepting industry standard modular RJ45 type plugs and insulation displacement conductor (IDC) terminations.

D. The Universal design shall support T568A and T568B wiring and shall have universal wiring labels, including color-coded insert identification labels to ensure accurate identification.

E. Color shall be specified or selected by Owner's Representative from manufacturer's standard colors.

F. Provide crosstalk cancellation with compensation and alien crosstalk mitigation using printed wiring board materials and compensation technology.

G. Jack shall be backward compatible with lower category cords and cables.

H. Low-profile wire cap shall protect against contamination and secure connection. Jacks shall be suitable for:

1. Modular patching applications or as modular TO
2. Installation without special faceplates at either 45- or a 90-degree angle in manufacturer's modular faceplates and frames, including those on surface-mounted boxes

I. Dimensions

1. Depth: 30.48 mm (1.20 in)
2. Height : 20.32 mm (0.80 in)
3. Width : 20.32 mm (0.80 in)

J. Electrical Specifications

1. Contact Resistance Variation, maximum: 20 mOhm
2. Contact Resistance, maximum: 100 mOhm
3. Current Rating : 1.5 A @ 20 °C, 1.5 A @ 68 °F
4. Dielectric Withstand Voltage, RMS, conductive surface : 1500 Vac @ 60 Hz
5. Dielectric Withstand Voltage, RMS, contact-to-contact : 1000 Vac @ 60 Hz
6. Insulation Resistance, minimum : 500 MOhm

K. Environmental Specifications

1. Flammability Rating: UL 94 V-0
2. Operating Temperature: -10 °C to +60 °C (+14 °F to +140 °F)
3. Relative Humidity : Up to 95%, non-condensing
4. Safety Standard: cUL , UL
5. Storage Temperature: -40 °C to +70 °C (-40 °F to +158 °F)

L. Mechanical Specifications

1. Conductor Type: Solid, Stranded (7 strands)
2. Material Type: Copper alloy, High-impact, flame retardant, thermoplastic
3. Outlet/Module Contact Plating: Precious metals
4. Plug Insertion Life, minimum: 750 times
5. Plug Insertion Life, test plug: IEC 60603-7 compliant plug
6. Plug Retention Force, minimum: 30 lbf, 133 N
7. Rear Termination Contact Plating: Precious metals
8. Rear Termination Type: IDC
9. Wiring: T568A or T568B
10. Can be mounted either at 90 degrees (straight) or 45 degrees (angled)
11. Angled feature eliminates the need for special faceplates

2.2. Category 6 Augmented (6A)/Class EA Outlets

A. Uniprise Category 6A M-Series Information Outlet. ***CHECK COLOR WITH OWNER BEFORE PROCURING THE MATERIAL***

B. Patented crossing of straddling pair contacts enables efficient alien crosstalk reduction in the channel.

C. Check Outlet color with owner prior to procuring material.

1. Optional Plastic Icons (M61A) and Dust Covers (M20A) available in several colors.

D. Optimal performance is achieved when using the Uniprise Category 6A patch cords; however, the UNJ600 is fully backwards compatible.

E. Can support network line speeds up to at least 10 gigabits per second.

F. Qualifies for the SYSTIMAX 25-Year Extended Product Warranty and Applications Assurance when included as part of a registered CommScope Category 6A channel.

G. Approved Manufacturer: CommScope

UNJ10G-YL (760149948) Category 6A U/UTP Information Outlet, yellow

2.3. Transition Point (Ceiling Connector Assembly)

A. The assembly shall be plenum rated.

B. Does not require special tooling for termination.

C. Accepts solid or stranded conductors (22-26 AWG)

D. Assembly accommodates Category 6A cabling to facilitate transition of OSP to indoor cable.

E. Available with pre-installed 18” Category 6A single ended cord to support Mod Plug Terminated Links (MPTL)

F. Approved Manufacturer: CommScope

CEILING CONN ASSEMBLY (760234921) Ceiling Connector Assembly, white

CCA-GS10E-Plenum-WHITE-N018 (760235592) Connector, Cat6a Plenum Pigtail, White, 18”

3. EXECUTION

3.1. Installation

A. Contractor shall comply applicable codes, standards and with all local codes and requirements. It is the responsibility of the contractor to identify and adhere to any unique codes or requirements governed by the region where the work is to be performed.

B. Jack/Information outlets and Connectors shall be installed following industry standard practices.

C. Horizontal cabling shall be terminated on a Jack/Information outlet which is the same category rating as the Cable. i.e. Cat 6A cable terminates on Cat 6A Jack/Information outlets.

D. Contractor shall not exceed the maximum pulling tension or the minimum bending radius for twisted pair cables per manufacturer’s specifications.

E. Contractor shall test all horizontal links per the ANSI/TIA-568 Requirements.

END of SECTION

27 15 43.15 Communications Fiber Connectors, Pigtails, Splice Accessories and Adapter Panels

1. GENERAL

1.1. Work Includes

Provide all labor, materials, and equipment for the complete installation of all Fiber Connectors, Pigtails and Adapter Panels called for in the Bid and Engineering Documents.

1.2. Scope of Work

A. This section includes the minimum requirements for Fiber Connectors, Pigtails and Adapter Panels.

B. The performance for the installation shall meet or exceed the requirements of ANSI/TIA-568 and ISO/IEC 11801 and other requirements as noted in this specification for the specified Fiber Type.

C. The connectors and adapters shall match the fiber type of the cabling

D. All connectors and adapters shall meet UL 94 V-O

1.3. Quality Assurance

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where

"approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

C. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

D. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:

ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,
TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,
ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
NFPA 70 – National Electric Code
BICSI – Telecommunications Distribution Methods Manual
Bellcore, fiber distributed data interface (FDDI), and EIA standards
ANSI/ICEA S-87-640, Standard for Optical Fiber Outside Plant Communications Cable
Telcordia's Generic Requirements for Optical Fiber and Optical Fiber Cable
TIA/EIA-568-C.3 – Optical Fiber Cabling Components Standard
ISO/IEC 11801 - Generic Cabling for Customer Premises
CENELEC EN-50173 - Generic Cabling Systems

1.4. Submittals

Provide product data for the following:
Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1.5. Coordination

Coordinate installation of Connectors, Pigtails and Adapter Panels with other trades.

2. PRODUCTS

2.1. General

A. All products will be:

1. Compliant to RoHS 2002/95/EC
2. Designed, manufactured and/or distributed under this quality management system: ISO 9001:2008

2.2. LC Fiber Connectors

A. LC Connectors with mechanical splice for use with OM2+, OM3 and OM4 multimode fiber or OS2 singlemode fiber.

1. Color coded per industry standard requirements to aide in identification during and after installation
2. Factory pre-polished for field installation
3. Mechanical splice technology
4. Must include a factory pre-cleaved fiber stub and a proprietary index-matching gel

5. Compatible with 250µm and 900µm optical fibers
6. Performance exceeds ANSI/TIA/EIA-568-C.2 standard
7. Complete tool kit with cleaning solution, wipes, and scrap fiber container designed for quick setup and tear-down
8. Factory-installed wedge clip shall be included with each connector; wedge is discarded upon completion of the termination
9. Translucent wedge shall enable the use of a common VFI to provide a "pass/fail" signal once physical contact is achieved
10. Capability to be re-terminated if the first installation fails
11. Shall not require a custom termination kit
12. Approved Manufacturer: CommScope

MFC-LCF-09-5X (760117887) LazrSPEED Fiber Qwik II LC Connector™, Aqua

MFC-LCF-09-5X-25 (760117911) LazrSPEED Fiber Qwik II LC Connector, Aqua, 25 Pack

SFC-LCR-09-8X (760117895) Behind the Wall LC Connector for 0.9 mm Buffered Fiber, singlemode

SFC-LCR-09-8X-25 (760117929) Behind the Wall LC Connector for 0.9 mm Buffered Fiber, singlemode, 25 pack

B. LC Connectors (epoxy-polish) for use with OM1, OM2+, OM3 and OM4 multimode fiber or OS2 singlemode fiber

1. Color – Beige
2. Ferrule Geometry - Pre-radiused
3. Ferrule Material - Zirconia
4. Performance meets or exceeds ANSI/TIA/EIA-568-C.3 standard
5. Insertion Loss, typical - 0.17 dB
6. Return Loss, minimum - 20.0 dB
7. Insertion Loss Change, mating - 0.30 dB
8. Insertion Loss Change, temperature - 0.30 dB
9. Approved Manufacturer: CommScope

MFC-LCR-09-BG (760034181) Behind the Wall LC Connector for 0.9 mm Buffered Fiber, multimode

SFC-LCR-09-BL (760034199) Behind The Wall LC Connector for 0.9 mm Buffered Fiber, singlemode

2.3. Splice Cassettes and Accessories

A. Fiber Splice Cassette

1. Designed for use in SD fiber shelf, which has the LGX/1000 Style footprint
2. Contains 12 or 24 color-coded buffer tubes
3. Fusions splices are utilized and managed inside the cassette after splicing
4. Splice cassette is provided with splice holder and splice protection sleeves
5. Does not require the use of breakout kits with loose tube fiber
6. Approved Manufacturer: CommScope

PNL-CS-12LCX-PT (760221739) OM4 Multimode Splicing Cassette, 12-fiber

PNL-CS-24LCX-PT (760221697) OM4 Multimode Splicing Cassette, 24-fiber

PNL-CS-12LCW-PT (760221747) OS2 Singlemode Splicing Cassette, 12-fiber

PNL-CS-24LCW-PT (760221705) OS2 Singlemode Splicing Cassette, 24-fiber

B. Fiber Breakout Kit

7. Protects Loose tube fibers when exposed from buffer tubes prior to splicing
8. Contains 12 color-coded buffer tubes and snap together housing

9. Approved Manufacturer: CommScope

12 FIBER BREAKOUT KIT (760018838) 12 Fiber Breakout Kit, loose tube

C. Fiber Splice Wallet

1. Provides protection for fusion splice joints
2. Accommodates 48 single fusion splices
3. Includes Splice Wallet, Fusion Splice Trays, and Fiber Storage drums
4. Approved Manufacturer: CommScope

KIT-SW-48-SFS-2FD (760148411) Splice Wallet Kit, 48 Single Fusion Splices (1x3x16), 1U/2U Shelf, 2 Fiber Drums

D. Fiber Splice Sleeves

1. Overall length is 42-mm
2. Approved Manufacturer: CommScope

757849-000 (SMOUV-1120-R2/12-02) SMOUV Fiber Optic Splice Heat Shrink Protective Sleeves, 50-pack

2.4. LC Fiber Pigtails

A. Pigtail Kits for use with OM1, OM2+, OM3 and OM4 multimode fiber or OS2 singlemode fiber

1. Color coded in 12-fiber kits, 2 m in length
2. Ferrule Material - Zirconia
3. Performance meets or exceeds ANSI/TIA/EIA-568-C.3 standard
4. Insertion Loss, typical - 0.17 dB
5. Return Loss, minimum - 20.0 dB
6. Insertion Loss Change, mating - 0.30 dB
7. Insertion Loss Change, temperature - 0.30 dB
8. Approved Manufacturer: CommScope

FAXLCUC0C (FAXLCUC0C-XXM002) OM4 Multimode LC to Unconnectorized, Fiber Pigtail, 0.9 mm Tight Buffer, 12-fiber Kit, Blue - Aqua (1-12), 2 m

FAWLCUC0C (FAWLCUC0C-XXM002) OS2 Singlemode LC to Unconnectorized, Fiber Pigtail, 0.9 mm Tight Buffer, 12-fiber Kit, Blue - Aqua (1-12), 2 m

2.5. LC Fiber Adapter Panels

A. Adapter for use with OM1, OM2+, OM3 and OM4 multimode fiber or OS2 singlemode fiber

1. Approved Manufacturer: CommScope

PNL-BK-012-MFA-LC02-AQ-SHUTTERED (760067173) Multimode 12-fiber Adapter Panel, Black, 1000-Type, with 6 LC duplex adapters, aqua, shuttered

PNL-BK-012-SFA-LC02-BL-SHUTTERED (760067165) Singlemode 12-fiber Adapter Panel, Black, 1000-Type, with 6 LC duplex adapters, blue, shuttered

3. EXECUTION

3.1. Installation

A. Contractor shall comply applicable codes, standards and with all local codes and requirements. It is the responsibility of the contractor to identify and adhere to any

unique codes or requirements governed by the region where the work is to be performed.

B. Fiber Pigtails and Adapter Panels shall be installed following industry standard practices.

C. Horizontal cabling shall be terminated on a Fiber Connectors, Adapters and Adapter Panels which is designed for the fiber type of the cable. i.e. Singlemode cable terminates on Singlemode Connectors and Adapters.

D. Contractor shall not exceed the maximum pulling tension or the minimum bending radius for twisted pair cables per manufacturer's specifications.

E. Contractor shall test all horizontal links per the Relevant Standards and Requirements.

END of SECTION

27 15 43.25 Work Area Faceplate/Wall Plates and Surface Mount Boxes

1. GENERAL

1.1. Work Includes

Provide all labor, materials, and equipment for the complete installation of all Faceplate/wall plates and Surface mount Boxes called for in the Bid Documents. Check face plate color requirements with owner. Normally it will be matched to the electrical outlets color.

1.2. Scope of Work

A. This section includes the minimum requirements for Faceplate/wall plates and Surface mount Boxes.

B. All Faceplates and Surface Mount boxes shall be constructed of high-impact, flame retardant; UL rated 94 V-0 Thermoplastic.

C. Faceplates and SMB shall be designed to accept the CommScope SYSTIMAX information outlets.

D. Number of outlets per faceplate shall be as detailed on the Telecommunications Drawings.

1.3. Quality Assurance

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

C. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

D. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:

ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,
TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,
ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
NFPA 70 – National Electric Code
BICSI – Telecommunications Distribution Methods Manual
TIA/EIA-568-C.1 – Commercial Building Telecommunications Cabling Standard
TIA/EIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards
TIA/EIA-568-C.3 – Optical Fiber Cabling Components Standard

ISO/IEC 11801 - Generic Cabling for Customer Premises
CENELEC EN-50173 - Generic Cabling Systems

1.4. Submittals

Provide product data for the following:
Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1.5. Coordination

Coordinate installation of Faceplate/wall plates and Surface mount Boxes with other trades.

2. PRODUCTS

2.1. Faceplates and Surface Mount Boxes (SMB)

A. Approved Manufacturer: CommScope

M14LE-262 (108333162) LE Type Flush Mounted Faceplate, four port white
M12LE-262 (108333063) LE Type Flush Mounted Faceplate, two port white
M10LW-262 (108258468) Wall Mount Telephone Faceplate, one port white
M102SMB-B-262 (107984056) Surface Mount Box, two port white
M104SMB-A-262 (107952459) Surface Mount Box, four port white

3. EXECUTION

3.1. Installation

A. Contractor shall comply applicable codes, standards and with all local codes and requirements. It is the responsibility of the contractor to identify and adhere to any unique codes or requirements governed by the region where the work is to be performed.

B. Faceplate/wall plates and Surface mount Boxes shall be installed following industry standard practices.

C. Contractor shall not exceed the maximum pulling tension or the minimum bending radius for twisted pair cables per manufacturer's specifications.

D. Contractor shall test all horizontal links per the ANSI/TIA-568 Requirements.

END of SECTION

27 16 00 Communications Connecting Cords, Devices and Adapters

27 16 19 Communications Patch Cords, Station Cords, and Cross-Connect Wire

27 16 19.02 Copper Patch Cords

1. GENERAL

1.1. Work Includes

Provide all labor, materials, and equipment for the complete installation of all Copper Patchcords into the approved patch panels called for in the Bid Documents.

1.2. Scope of Work

A. This section includes the minimum requirements for Copper Patch Cords.

B. All Patch/Equipment Cords shall be new.***PROVIDE PATCH CORDS PER CODED COLOR: BLUE FOR DATA, YELLOW FOR ACCESS POINTS AND WHITE FOR CAMERAS. 5 FT LONG FOR COMMUNICATIONS ROOM SIDE AND 15 FT LONG FOR USER SIDE.***

C. On new installations, Patch/Equipment Cords shall be made by the same manufacturer as the Horizontal Cable used in the new installation.

D. Patch/Equipment Cords shall be available in multiple colors. Colors required are to be detailed in the Bid Documents.

E. All Patch/Equipment Cords shall be factory manufactured and tested for compliance to the appropriate standards and performance.

F. Patch/Equipment Cord length shall be determined by the end user.

G. Patch/Equipment Cords shall be installed using proper cable management.

H. Minimum bend radius shall not be exceeded.

1.3. Quality Assurance

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

C. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

D. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:

ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,
TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,
ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
NFPA 70 – National Electric Code
BICSI – Telecommunications Distribution Methods Manual
ANSI/ICEA S-87-640, Standard for Optical Fiber Outside Plant Communications Cable
Telcordia, GR-20-CORE, Generic Requirements for Optical Fiber and Optical Fiber Cable

1.4. Submittals

Provide product data for the following:
Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1.5. Coordination

Coordinate layout and installation of Patch/Equipment Cords with other trades.

2. PRODUCTS

2.1. Category 6 Augmented (6A)/Class EA Patch Cords

A. The Modular Patch Cords shall meet or exceed the channel specifications of Amendment 1 to ISO/IEC 11 801:2002 Class EA and ANSI/TIA-568-C.2 Category 6A up to 500 MHz when used as part of a UTP Channel. Check patch cord colors with owner prior to procuring material.

1. Approved Manufacturer: CommScope

UNC10G-YL-7FT (UC1AAA2-09F007) Uniprise Category 6A U/UTP Patch Cord, RJ45 to RJ45, 4-pair, Non-Plenum, Blue Jacket, 7 ft

UNC10G-YL-10FT (UC1AAA2-09F0010) Uniprise Category 6A U/UTP Patch Cord, RJ45 to RJ45, 4-pair, Non-Plenum, Blue Jacket, 10 ft

3. EXECUTION

3.1. Installation

A. Copper Jumpers/patch cables

1. Contractor shall comply applicable codes, standards and with all local codes and requirements. It is the responsibility of the contractor to identify and adhere to any unique codes or requirements governed by the region where the work is to be performed.
2. Cable shall be installed following industry standard practices.
3. Contractor shall not exceed the maximum pulling tension or the minimum bending radius for copper cables per manufacturer's specifications.

END of SECTION

27 16 19.03 Optical Fiber Cords

1. GENERAL

1.1. Work Includes

Provide all labor, materials, and equipment for the complete installation of all OM4 Multimode Optical Fiber Cordsand OS2 Singlemode Optical Fiber Cords into the approved patch panels called for in the Bid Documents.

1.2. Scope of Work

A. This section includes the minimum requirements for Fiber Patch Cords.

B. All Patch/Equipment Cords shall be new.

C. On new installations, Patch/Equipment Cords shall be made by the same manufacturer as the Horizontal Cable used in the new installation.

D. Patch/Equipment Cords shall be available in multiple colors. Colors required are to be detailed in the Bid Documents.

E. All Patch/Equipment Cords shall be factory manufactured and tested for compliance to the appropriate standards and performance.

F. Patch/Equipment Cord length shall be determined by the end user.

G. Patch/Equipment Cords shall be installed using proper cable management.

H. Minimum bend radius shall not be exceeded.

1.3. Quality Assurance

A. All cable and equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative.

B. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

C. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

D. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:

ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,
TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,
ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
NFPA 70 – National Electric Code
BICSI – Telecommunications Distribution Methods Manual

ANSI/ICEA S-87-640, Standard for Optical Fiber Outside Plant Communications Cable

Telcordia, GR-20-CORE, Generic Requirements for Optical Fiber and Optical Fiber Cable

1.4. Submittals

Provide product data for the following:
Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1.5. Coordination

Coordinate layout and installation of Fiber Cords and Pigtails with other trades.

2. PRODUCTS

2.1. Optical Fiber Patch Cords

To maintain channel integrity, optical fiber patch cords and pigtails shall be fabricated to meet the performance parameters corresponding to the optical fiber cable approved product type specified below. Patch cord and pigtail plug connectors shall be equipped with boots and shall have same colors as related optical fiber backbone cables, unless specified or indicated otherwise. Optical fiber patch cords and pigtails shall be available with the following options as indicated on the bid document.***FIBER CORDS MUST BE PROVIDED FOR 100% OF THE LINKS AT THE FIBER ENCLOSURES AT BOTH ENDS OF THE CONNECTION. CHECK LENGTHS AND CONNECTOR TYPE WITH OWNER BEFORE PROCURING THE MATERIAL***

2.2. Termination types:

A. LC-LC and LC-SC Patch Cords may be required, depending on active equipment.

B. LC and SC Patch cord outside diameters:

1. Duplex: 1.6 mm x 3.3 mm (0.063 in x 0.130 in)

C. Lengths: As specified in the bid document

D. All patch cords must be constructed with the appropriate jacket material (OFNR) for the pathway in which the cable will be routed.

E. All 50 micron optical jumpers shall be constructed using OM4 fiber.

F. All singlemode optical jumpers shall be constructed using OS2 fiber.

G. Approved Manufacturer: CommScope

FEXLCLC42 (FEXLCLC42-MXF003)OM4 LC to LC, Fiber Patch Cord, 1.6 mm Duplex, Riser, aqua jacket, 3 ft

FEXLCLC42 (FEXLCLC42-MXF005) OM4 LC to LC, Fiber Patch Cord, 1.6 mm Duplex, Riser, aqua jacket, 5 ft

FEXLCLC42 (FEXLCLC42-MXF007) OM4 LC to LC, Fiber Patch Cord, 1.6 mm Duplex, Riser, aqua jacket, 7 ft

FEXLCLC42 (FEXLCLC42-MXF010) OM4 LC to LC, Fiber Patch Cord, 1.6 mm Duplex, Riser, aqua jacket, 10 ft

FEXLCSC42 (FEXLCSC42-MXF003) OM4 LC to SC, Fiber Patch Cord, 1.6 mm Duplex, Riser, aqua jacket, 3 ft

FEXLCSC42 (FEXLCSC42-MXF005) OM4 LC to SC, Fiber Patch Cord, 1.6 mm Duplex, Riser, aqua jacket, 5 ft

FEXLCSC42 (FEXLCSC42-MXF007) OM4 LC to SC, Fiber Patch Cord, 1.6 mm Duplex, Riser, aqua jacket, 7 ft

FEWLCSC42 (FEXLCSC42-JXF010) OS2LC to SC, Fiber Patch Cord, 1.6 mm Duplex, Riser, yellow jacket, 10 ft

FEWLCLC42 (FEWLCLC42-JXF003) OS2 LC to LC, Fiber Patch Cord, 1.6 mm Duplex, Riser, yellow jacket, 3 ft

FEWLCLC42 (FEWLCLC42-JXF005) OS2 LC to LC, Fiber Patch Cord, 1.6 mm Duplex, Riser, yellow jacket, 5 ft

FEWLCLC42 (FEWLCLC42-JXF007) OS2 LC to LC, Fiber Patch Cord, 1.6 mm Duplex, Riser, yellow jacket, 7 ft

FEWLCLC42 (FEWLCLC42-JXF010) OS2 LC to LC, Fiber Patch Cord, 1.6 mm Duplex, Riser, yellow jacket, 10 ft

FEWLCSC42 (FEWLCSC42-JXF003) OS2 LC to SC, Fiber Patch Cord, 1.6 mm Duplex, Riser, yellow jacket, 3 ft

FEWLCSC42 (FEWLCSC42-JXF005) OS2 LC to SC, Fiber Patch Cord, 1.6 mm Duplex, Riser, yellow jacket, 5 ft

FEWLCSC42 (FEWLCSC42-JXF007) OS2 LC to SC, Fiber Patch Cord, 1.6 mm Duplex, Riser, yellow jacket, 7 ft

FEWLCSC42 (FEWLCSC42-JXF010) OS2 LC to SC, Fiber Patch Cord, 1.6 mm Duplex, Riser, yellow jacket, 10 ft

3. EXECUTION

3.1. Installation

A. Fiber Optic Jumpers/patch cables

1. Contractor shall comply applicable codes, standards and with all local codes and requirements. It is the responsibility of the contractor to identify and adhere to any unique codes or requirements governed by the region where the work is to be performed.
2. Cable shall be installed following industry standard practices.
3. Contractor shall not exceed the maximum pulling tension or the minimum bending radius for fiber cables per manufacturer's specifications.
4. All installations shall comply with:
   ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,
   TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,
   ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
   ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
   NFPA 70 – National Electric Code
   BICSI – Telecommunications Distribution Methods Manual

END of SECTION

Summary of Part Numbers

Part Number	Description Code	Description
760082479	RK3-45A	3 in (76 mm) Channel x 7ft (2134 mm) H - 19 in (482.6 mm) AI Equipment Rack (45U) 12-24 Tapped Rails, Black
760082529	RK4P45-29A	29 in (737 mm) D x 7ft (2134 mm) H - 19 in (482.6 mm) Al Equipment Rack (45U) 12-24 Tapped Rails, Black
760089367	VCM-DS-84-10B	Vertical Cable Management Kit, 10in X 84in (254mm X 2134mm) Double Sided, With Doors, Black
760089375	VCM-DS-84-12B	Vertical Cable Management Kit, 12in X 84in (305mm X 2134mm) Double Sided, With Doors, Black
760072959	HTK-19-SS-2U	Horizontal Trough Kit, 2 RU, 19 in, single sided
760072967	HTK-19-SS-3U	Horizontal Trough Kit, 3 RU, 19 in, single sided
760207274	CPP-UDDM-M-1U-24	Discrete Distribution Module Panel, M-series, UTP, 1U, 24 port
760207282	CPP-UDDM-M-2U-48	Discrete Distribution Module Panel, M-series, UTP, 2U, 48 port
760231449	SD-1U	Standard Density 1U sliding Panel
760231456	SD-2U	Standard Density 2U sliding Panel
760231464	SD-4U	Standard Density 4U sliding Panel
760085647	CR-SLR-10L12W	Cable Runway 10 ft (3048mm) L x 12 in (305mm) W, Black
760085654	CR-SLR-10L18W	Cable Runway, 10 ft (3048 mm) L x 18 inch (457 mm) W, black
760085662	CR-SLR-10L24W	Cable Runway, 10 ft (3048 mm) L x 24 inch (610 mm) W, black
760085530	CR90FCB-12W	Cable Runway, 90° radius flat corner bend, 12 inch (305 mm) W, black
760085548	CR90FCB-18W	Cable Runway, 90° radius flat corner bend, 18 inch (457 mm) W, black
760085555	CR90FCB-24W	Cable Runway, 90° radius flat corner bend, 24 inch (610 mm) W, black
760084012	CRPECK	Cable Runway, protective end cap kit (2 caps), black

760084046	CRTJSK	Cable Runway, junction splice kit, black
760083899	CRBSK	Cable Runway, butt splice kit, black
760083956	CRDK-12W	Cable Runway, rung drop out ,12 inch (305 mm) W, black
760083980	CRRP-8H	Cable Runway, cable retaining post, 8 inch (203 mm) H (1 Each), black
760054296	D-024-LN-5K-F12NS	Single Jacket All-Dielectric, Gel-Free, Outdoor Stranded Loose Tube Cable
760053744	D-024-LA-5K-F12NS	Single Jacket/Single Armor, Gel-Free, Outdoor Stranded Loose Tube Cable
760037457	P-024-OD-5K-FSUBK	Indoor/Outdoor Plenum Distribution Cable, 24 fiber single-unit
760134981	P-024-OZ-5K-FSUBK	Indoor/Outdoor Plenum Distribution Cable, interlocking aluminum armored with plenum jacket, 24 fiber single-unit
760018697	P-024-DS-5K-FSUAQ	Plenum Distribution Cable, 24 fiber single-unit
760127910	P-024-DZ-5K-FMUAQ	Plenum Distribution Cable Interlocking Aluminum Armored with Plenum Jacket 24-Fiber Multi-Unit with 6-Fiber Subunits
UN884019904/10	CS34O BLK C6 4/24 U/UTP RL 1KFT	Category 6 U/UTP filled Cable, outdoor direct burial, black jacket, 4 pair count, 1000 ft (305 m) length, reel
UN874035114/10	CS44P BL C6A 4/23 U/UTP CPK 1KFT	Category 6A U/UTP Cable, plenum, bluejacket, 4 pair count, 1000 ft (305 m) length reel
760178129	1592A BK 4/24 R1000	1592A Category 6A F/UTP Cable, outdoor, black jacket, aluminum tape shield, inner jacket, 4 pair count, 1000 ft (305 m) length, reel
760155011	UNJ10G-BL	Uniprise Ultra 10® UNJ10G Category 6A U/UTP Information Outlet, BL
760234921	CEILING CONN ASSEMBLY	Ceiling Connector Assembly, white
760235588	CCA-GS8E-Plenum-WHITE-N018	Connector, Cat6 Plenum Pigtail, White, 18”
760235592	CCA-GS10E-Plenum-WHITE-N018	Connector, Cat6a Plenum Pigtail, White, 18”
760117887	MFC-LCF-09-5X	LazrSPEED® Fiber Qwik II-LC Connector™, field installable, aqua

760117911	MFC-LCF-09-5X-25	LazrSPEED® Fiber Qwik II-LC Connector™, field installable, aqua, 25 Pack
760117895	SFC-LCR-09-8X	TeraSPEED® Fiber Qwik II-LC Connector™, field installable, blue
760117929	SFC-LCR-09-8X-25	TeraSPEED® Fiber Qwik II-LC Connector™, field installable, blue, 25 Pack
760034181	MFC-LCR-09-BG	Behind The Wall Pre-Radiused LC Connector for 0.9 mm Fiber, multimode
760034199	SFC-LCR-09-BL	Behind The Wall Pre-Radiused LC Connector for 0.9 mm Fiber, singlemode
760221739	PNL-CS-12LCX-PT	OM4 Multimode Splicing Cassette, 12-fiber
760221697	PNL-CS-24LCX-PT	OM4 Multimode Splicing Cassette, 24-fiber
760221747	PNL-CS-12LCW-PT	) OS2 Singlemode Splicing Cassette, 12-fiber
760221705	PNL-CS-24LCW-PT	) OS2 Singlemode Splicing Cassette, 24-fiber
760018838	12 FIBER BREAKOUT KIT	12 Fiber Breakout Kit, loose tube
760148411	KIT-SW-48-SFS-2FD	Splice Wallet Kit, 48 Single Fusion Splices (1x3x16), 1U/2U Shelf, 2 Fiber Drums
SMOUV-1120-R2/12-02	757849-000	SMOUV Fiber Optic Splice Heat Shrink Protective Sleeves, 50-pack
FAXLCUC0C	FAXLCUC0C-XXM002	LazrSPEED® 550 LC to Unconnectorized, Fiber Pigtail, 0.9 mm Tight Buffer, 12-fiber Kit, Blue - Aqua (1-12), 2 m
FAWLCUC0C	FAWLCUC0C-XXM002	TeraSPEED® LC to Unconnectorized, Fiber Pigtail, 0.9 mm Tight Buffer, 12-fiber Kit, Blue - Aqua (1-12), 2 m
760067173	PNL-BK-012-MFA-LC02-AQ-SHUTTERED	Multimode 12-fiber Adapter Panel, Black, 1000-Type, with 6 duplex LC adapters, aqua, shuttered
760067165	PNL-BK-012-SFA-LC02-BL-SHUTTERED	Singlemode 12-fiber Adapter Panel, Black, 1000-Type, with 6 LC duplex adapters, blue, shuttered
108333162	M14LE-262	LE Type Flush Mounted Faceplate, four port white

108333063	M12LE-262	LE Type Flush Mounted Faceplate, two port white
108258468	M10LW-262	Wall Mount Telephone, one port white
107984056	M102SMB-B-262	M102 Type Surface Mount Box, dual port white
107952459	M104SMB-A-262	M104 Type Surface Mount Box, four port white
UC1AAA2-0ZF007	UNC10G-BL-7FT	Uniprise Ultra 10® Category 6A U/UTP Patch Cord, Snagless, BL Jacket
UC1AAA2-0ZF010	UNC10G-BL-10FT	Uniprise Ultra 10® Category 6A U/UTP Patch Cord, Snagless, BL jacket
FEXLCLC42	FEXLCLC42-MXF003	LazrSPEED® 550 LC to LC, Fiber Patch Cord, 1.6 mm Duplex, Riser, aqua jacket, 3 ft
FEXLCLC42	FEXLCLC42-MXF005	LazrSPEED® 550 LC to LC, Fiber Patch Cord, 1.6 mm Duplex, Riser, aqua jacket, 5 ft
FEXLCLC42	FEXLCLC42-MXF007	LazrSPEED® 550 LC to LC, Fiber Patch Cord, 1.6 mm Duplex, Riser, aqua jacket, 7 ft
FEXLCLC42	FEXLCLC42-MXF010	LazrSPEED® 550 LC to LC, Fiber Patch Cord, 1.6 mm Duplex, Riser, aqua jacket, 10 ft
FEXLCSC42	FEXLCSC42-MXF003	LazrSPEED® 550 LC to SC, Fiber Patch Cord, 1.6 mm Duplex, Riser, aqua jacket, 3 ft
FEXLCSC42	FEXLCSC42-MXF005	LazrSPEED® 550 LC to SC, Fiber Patch Cord, 1.6 mm Duplex, Riser, aqua jacket, 5 ft
FEXLCSC42	FEXLCSC42-MXF007	LazrSPEED® 550 LC to SC, Fiber Patch Cord, 1.6 mm Duplex, Riser, aqua jacket, 7 ft
FEXLCSC42	FEXLCSC42-MXF010	LazrSPEED® 550 LC to SC, Fiber Patch Cord, 1.6 mm Duplex, Riser, aqua jacket, 10 ft
FEWLCLC42	FEWLCLC42-JXF003	TeraSPEED® LC to LC, Fiber Patch Cord, 1.6 mm Duplex, Riser, yellow jacket, 3 ft
FEWLCLC42	FEWLCLC42-JXF005	TeraSPEED® LC to LC, Fiber Patch Cord, 1.6 mm Duplex, Riser, yellow jacket, 5 ft

FEWLCLC42	FEWLCLC42-JXF007	TeraSPEED® LC to LC, Fiber Patch Cord, 1.6 mm Duplex, Riser, yellow jacket, 7 ft
FEWLCLC42	FEWLCLC42-JXF010	TeraSPEED® LC to LC, Fiber Patch Cord, 1.6 mm Duplex, Riser, yellow jacket, 10 ft
FEWLCSC42	FEWLCSC42-JXF003	TeraSPEED® LC to SC, Fiber Patch Cord, 1.6 mm Duplex, Riser, yellow jacket, 3 ft
FEWLCSC42	FEWLCSC42-JXF005	TerarSPEED® LC to SC, Fiber Patch Cord, 1.6 mm Duplex, Riser, yellow jacket, 5 ft
FEWLCSC42	FEWLCSC42-JXF007	TeraSPEED® LC to SC, Fiber Patch Cord, 1.6 mm Duplex, Riser, yellow jacket, 7 ft
FEWLCSC42	FEWLCSC42-JXF010	TeraSPEED® LC to SC, Fiber Patch Cord, 1.6 mm Duplex, Riser, yellow jacket, 10 ft

THE END

SECTION 27 05 33

CONDUITS AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions apply to work covered by this Section.

B. Comply with Sections 26 00 00, as applicable. Refer to other Sections for coordination of work.

1.2 SCOPE OF WORK

A. Provide labor, materials, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of a telephone and data communications empty conduit system, including all related systems and accessories.

1.3 SUBMITTALS

A. Submit product data and shop drawings in accordance with the Architectural sections.

PART 2 - PRODUCTS

2.1 GENERAL

A. Conduit, conduit sleeves, outlet boxes, cover plates and pullwire as indicated.

B. Fireproofing material for telephone and data communication conduit and conduit sleeves through fire rated walls and floors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install telephone and data communication raceways as indicated.

B. Install individual raceways from telephone and data communications outlets to above accessible ceiling. In areas without a ceiling, raceways shall be routed to the nearest ceiling space. In building without a ceiling, raceways shall be extended back to the main telephone/ data communication board or to a location indicated on the Drawings.

1 Minimum size conduit: 1.5 inch, REFER TO PLANS FOR SIZES.

2 Raceway installation shall be in accordance with Section 26 05 33.

3 Coordinate raceway installations in millwork and other fabricated architectural items with the other portions of the Work.

4 Provide pullwire in each raceway tagged on each end.

5 Raceways shall be terminated with an insulating bushing or a suitable connector with an insulated throat.

C. Provide telephone and data communications outlet boxes.

6 Provide a one-gang outlet unless noted otherwise.

7 Install outlet box and device ring at each location.

8 Install telephone and data communications outlets at same height specified for convenience outlets unless noted otherwise. Group telephone and data communications outlets with related receptacle outlets unless noted otherwise.

9 Install a blank cover plate on all unused communications outlet boxes.

END OF SECTION

SECTION 27 20 00

UNINTERRUPTED POWER SUPPLY

PART1 GENERAL

1.1 SECTIONINCLUDES

A. Uninterrupted Power Supplies (UPS) for communications closets.

1.2 RELATEDSECTIONS

A. See Section 270000 and 280000 for equipment requirements.
B. Refer to Section 260000 for electrical requirements.

1.3 REFERENCES

A. ISO 9001:2008 – Quality Management Systems –Requirements.

B. TIA/EIA 568 – Commercial Building Telecommunications CablingStandard.

1.4 SYSTEMDESCRIPTION

A. Components:
   1. UPS units must be provided to all communications rooms according to the equipment that they will support at each cabinet.
   2. UPS units must be connected to the electrical generator circuits.
   3. Equipment load calculations should be done at no more than 50% of UPS capacity.
   4. Basis of design should be APC Smart-UPS product line.
   5. All electronic equipment provided by the special systems contractor must be connected to an UPS.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data, including installationinstructions and battery calculations.

B. Shop Drawings: Submit thefollowing:
   1. Wiring Diagrams: Indicate wiring for each item of equipment and interconnections between items of equipment.
   2. Include manufacturer's names, model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduitlayouts.

C. Installation and OperationManuals:
   1. Submit manufacturer's installation and operation manual, includingoperation instructions and component wiringdiagrams.
   2. Provide detailed information required for Owner to properly operateequipment.

D. Warranty: Submit manufacturer's standardwarranty.

1.6 QUALITYASSURANCE

A. Manufacturer's Qualifications: ISO 9001:2008 certifiedcompany.

1.7 DELIVERY, STORAGE, ANDHANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name andmanufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials during handling and installation to preventdamage.

1.8 WARRANTY

A. Warranty Period: 1 years from date of SubstantialCompletion.

PART2 PRODUCTS

2.1 MANUFACTURER

A. APC by Schneider Electric. 132 Fairgrounds Road. West Kingston, RI 02892. Phone (877) 272-2722. Web site: www.apc.com
B. For MDF Rooms use APC smart-UPS, Line interactive, 1500VA,rackmount 3u, Scalable#SMTL1500RM3UC
C. Backplate kit with L6-20R & L5-20 (SYPD7 and SYSAPD1)
D. APC Rack PDUs
E. Contractor should calculate battery capacity to run UPS system at full capacity for 30 minutes on battery time.

PART3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive UPS system.

B. Notify Architect of conditions that would adversely affect installation or subsequentuse.

C. Do not begin installation until unacceptable conditions arecorrected.

3.2 INSTALLATION

A. Install UPSSystem in accordance with manufacturer's instructions at locations indicated on theDrawings.

B. Mount equipment plumb, level, square, andsecure.

3.3 DEMONSTRATION ANDTRAINING

A. Demonstration:
   1. Demonstrate that UPSSystem functionsproperly.
   2. Perform demonstration at final system inspection by qualified representativeof manufacturer.

B. Instruction andTraining:
   1. Provide instruction and training of Owner's personnel as required for operationof UPSSystem.
   2. Provide hands-on demonstration of operation of system components and complete system, including user-level program changes andfunctions.
   3. Provide instruction and training by qualified representative ofmanufacturer.

3.4 PROTECTION

A. Protect UPSSystem from damageduring construction.

END OF SECTION

SECTION 27 30 00

NETWORK EQUIPMENT

27 30 00 General RequirementsNetwork Requirements.

27 30 01 Summary

A. All Network equipment shall be provided by a Certified Partner with a local office within a 50-mile radius of the project location.

B. Wireless devices are used by the owner as part of the day-to-day operations. Provide a fully functional system per locations shown on the plans.

C. All wireless equipment provided must meet the IEEE 802.11 standard for 2.4 and 5Ghz bands.

D. A predictive wireless site survey must be done by the contractor to bid the required equipment. The Access point locations in the drawings are for reference only but the contractor must make his/her own calculations to provide a full coverage of the required areas.

E. Components to be included in the bid must include: Access Points, Antennas, mounting hardware, controllers, PoE switches, surge protection, poles, etc.

F. Propose equipment is basis of design, provide equals.

27 3002 Wireless Product Specifications

A. Network Standards must be IEEE 802.11b, 802.11g and 802.11n High Rate compliant and certified.

B. 802.11b for standard transmissions, 802.11g is strongly recommended for heavy graphics and video transfer.

C. IEEE High Rate-compliant roaming.

D. Compatible with Windows operating systems.

E. Media Access control: Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA).

F. Security: Access Control Lists; WEP Encryption (Open system, 64 bit, and 128 bit), VPN capability, USB, Enterprise AP and Gateway provide physical lock mechanism to help deter theft; 802.1x support provided in PC card via future Web download.

G. Network Architecture: Must support peer-to-peer (ad-hoc) networking and communication to wired networks via Access Points and Gateways.

H. Mounting: Gateway and Access points can mount on ceiling or wall, or rest on flat surface

I. Antenna: Flexible Gateway and APWE Access Point antenna

J. Network Management: SNMP, Enterprise Access Point with Embedded Web Server, Telnet, and tFTP Embedded Web browser configuration tool.

K. APPROVED PRODUCTS:

1. Aruba AP-515 for Indoor Access Points.

2. Aruba AP-375 for Outdoor Access Points.

3. Contractor shall include mounting brackets and software licenses as needed.

27 30 03 Wired Product Specifications

A. Cisco Unified Access Data Plane (UADP) Application-Specific Integrated Circuit (ASIC) ready for next-generation technologies with its programmable pipeline, microengine capabilities, and template-based, configurable allocation of Layer 2 and Layer 3 forwarding, Access Control Lists (ACLs), and Quality-of-Service (QoS) entries
B. IPv6 support in hardware, providing wire-rate forwarding for IPv6 networks
C. Dual-stack IPv4/IPv6 and dynamic hardware forwarding table allocations, for ease of IPv4-to-IPv6 migration
D. Hardware support for Application Hosting (e.g. with Cisco ThousandEyes Enterprise Agent).
E. IEEE 802.1ba AV Bridging (AVB) built in to provide a better AV experience through improved time synchronization and QoS
F. Precision Time Protocol (PTP; IEEE 1588v2) provides accurate clock synchronization with sub-microsecond accuracy, making it suitable for distribution and synchronization of time and frequency over the network
G. Support for both static and dynamic NAT and Port Address Translation (PAT)
H. Cisco StackWise Virtual technology, a network system virtualization technology that increases operational efficiency and boosts nonstop communications and scaled system bandwidth. Multichassis EtherChannel can be configured across StackWise-Virtual members for high resiliency
I. Platinum-rated (90% efficient) AC and/pr DC power supplies
J. Field-replaceable fan-tray units.
K. APPROVED PRODUCTS: (Provide equals)

1. For Core Switch Cisco Catalyst 9500 16-port 10G, K12
2. For Access Switches: Access Switches: Catalyst 9200 48ports PoE+ with 4 x 10G ports. Calculate all the ports needed for data, access points and security + 15% more for future growth.
3. Provide SFP 10G SR SFP Modules as needed.
4. Provide 1M Stacking cables as needed
5. For Telephony/Voice: Cisco ISR 4331 with (2) PRI Trunks and (8) POTS Lines
6. Provide Cisco ATA191 as needed
7. For user phones (1 per offices): Cisco 8841
8. For conference rooms: Cisco IP Conference 8832
9. Provide all software and licenses for a turn-key system.

27 30 05 EXECUTION.

A. Contractor shall comply applicable codes, standards and with all local codes and requirements. It is the responsibility of the contractor to identify and adhere to any unique codes or requirements governed by the region where the work is to be performed.
B. System must be tested to ensure it performs as intended.

C. Final site survey must be done after installation and the heat maps should be included as part of the as-built close out documentation.

D. Contractor to include training for owner personnel to use systems per the designed functionality.

27 30 06 Warranty.

A. Product should carry manufacturer warranty for at least three years and one year labor warranty.

B. Provide Cisco Smart Net Total Care 8 x 5 x Next Business Day Maintenance Contract for all furnished products by Cisco.

END of SECTION

SECTION 27 50 00

IN-BUILDING CELLULAR AMPLIFICATION SYSTEM TECHNICAL

PART 1 - GENERAL

1.01 SECTIONINCLUDES

This specification describes technical and performance criteria for deploying a In-Building Cellular Amplification System capable of supporting WirelessService Providers (WSP). The components specified in this document include: Donor Antennas, Coverage Antennas, Coax Cable, Singlemode duplex fiber, composite fiber with singlemode duplex and 16/2 AWG copper, and analog repeater. Include all cost in bid for a complete operation system.

1.02 SYSTEMDESCRIPTION

A. Services: Upon commissioning, the In Building cellular amplification system shall provide coverage for the WSPs listed below on all frequencies currently being used by the designated WSPs in the given market that has an exterior signal level is -105 dBm RSRP orgreater.

1. AT&T
2. Sprint
3. T-Mobile
4. Verizon
5. USCellular

Service	Downlink
Cellular	870 - 894
PCS	1930 - 1995
AWS	2110 - 2155
700 LTE	728 - 756

B. WSP Notification: The Contractor shall register the repeaters with at leastone WSP through their web site that the repeaterswill be connected to the WSPs' macronetworks.

1.03 ALTERNATIVES

A. No alternative component(s) shall be accepted as equal to the componentsand manufacturers specified in thisdocument

1.04 CODES, STANDARDS ANDCERTIFICATIONS

A. All work, including but not limited to: cabling, pathways, support structures, wiring, equipment, installation, workmanship, maintenance and testing shall comply with the latest editions of the National Electrical Code, National Electrical Safety Code, all applicable local rules and regulations, equipment manufacturer's instructions, and the National Electrical Contractors Association (NECA) Standard of Installation. In case of discrepancy or disagreement between the documents noted above, the contractor shall

satisfy the most stringentrequirements.

B. It is the Contractor's responsibility to ensure that the components comply with local code, ordinances or requirements established by theAHJ.

1.05 ABBREVIATIONS AND ACRONYMS

A. AHJ: Authority Having Jurisdiction
B. ATP: Acceptance Test Plan
C. AWS: Advanced Wireless Service
D. BDA: Bi-Direction Amplifier
E. BOM: Bill-of-Material
F. DAS: Distributed Antenna System
G. DAQ: Digital Audio Quality
H. ESMR: Enhanced Specialized Mobile Radio
I. FCC: Federal Communications Commission
J. iDEN: Integrated Enhanced Digital Network
K. LMR: Land Mobile Radio
L. LTE: Long Term Evolution
M. MTBF: Mean Time Between Failure
N. NFPA: National Fire Protection Association
O. NMS: Network Management System
P. PCS: Personal Communications System
Q. PSN: Public Safety Network
R. RoF: Radio-over-Fiber
S. RoHS: Restriction of Hazardous Substances
T. RSL: Received Signal Level
U. SIMO: Single-Input, Multiple-Output
V. SISO: Single-Input, Single-Output
W. SMR: Specialized Mobile Radio
X. SMS: Short Message Service
Y. SNMP: Simple Network Management Protocol
Z. SOW: Statement of Work
AA. VSWR: Voltage Standing Wave Ratio
BB. WSP: Wireless Service Provider

1.06 DEFINITIONS

A. Acceptance: Expressed approval by the customer
B. Active: Components that require AC/DC power for operation
C. Channel: A path for an RF transmission between two points
D. Component: A main system element of the Amplification system
E. Contractor: The prime contractor bidding the project
F. Delivered Audio Quality (DAQ): A measure of audio quality over a transmission medium used to quantify the quality of audio heard over a radio system. DAQ levels are defined by the following scale:
    a. DAQ 1: Unusable. Speech present but notunderstandable.
    b. DAQ 2: Speech understandable with considerable effort.Requires frequent repetition due to noise or distortion.
    c. DAQ 3: Speech understandable with slight effort.Requires

occasional repetition due to noise or distortion.

d. DAQ 3.4: Speech understandable without repetition. Some noiseor distortion present.
e. DAQ 4: Speech easily understandable. Little noise ordistortion.
f. DAQ 5: Perfect. No distortion or noisediscernible.

G. Sub-contractor: A qualified and experienced integrator performing the deployment for the Contractor.

H. Head-End Equipment: The equipment that accepts the RF Source, andthen typically amplifies the RF source to the interior antennas

I. Passive: Components that do not require AC/DC power foroperation

1.07 PERFORMANCE REQUIREMENTS

A. WSP:

1. On a per channel basis, the downlink RSL for each frequency bandshall meet or exceed the criteria in Table1.

Table 1. System Parameters

Parameters	Unit	700 LTE	Cellular, PCS, AWS, Commercial 800 MHz
Minimum downlink receive signal RSRP	dBm	-105	-105

2. Contractor shall state the assumed channel loading and frequency bands for the proposed WSP in-building coverage. Prior to installation, contractors shall confirm the channel loading and frequency use in the serving area and shall guarantee coverage for these channels per the criteria in Table1.
3. The system shall deliver coverage per the criteria in Table 1throughout 95% of the building.

1.08 SUBMITTALS

A. SubmittalRequirements:

1. Product Data: Submit manufacturer datasheets for thefollowing components:
   a. Coverage Antennas
   b. CoaxialCable
   c. Singlemode duplexFiber
   d. Repeaters
   e. Masts
   f. Donorantennas
2. Shop Drawings: Submit the following items:
   a. RF linkbudget
   b. Overlay of system Components on floorplans
   c. Drawings for Donor Antenna andgrounding
   d. Bill-of-Material(BOM)

3. Statement of Work (SOW): Submit sampleSOW
4. Acceptance Test Plan (ATP): Submit sample ATP
5. Recommended Spares
6. WarrantyDocuments:
   a. Submit for all manufactured Components specified in thisSection.
   b. Submit Contractor's SystemWarranty.
   c. Submit Manufacturer'sWarranty.

B. Submittal Requirements Prior to Start ofConstruction

1. Final RF linkbudget
2. Overlay of system Components on floorplans
3. Drawings for Donor Antenna andgrounding
4. RF propagation modeling
5. Bill-of-Material(BOM)
6. Maintenance ServiceContract
7. Statement of Work (SOW): The contractor shall submit a SOW that has been accepted by the customer or customer's designatedrepresentative.
8. Acceptance Test Plan (ATP): The contractor shall submit an ATP thathas been accepted by the customer or customer's designatedrepresentative.

C. Submittal Requirements at CloseOut

1. Drawings: Submit as-built drawingsindicating:
   a. Donor antenna, grounding and lighting protectiondetails
   b. Cable routing, splitters, couplers and coverage antennalocations
   c. Active component locations, layout andconfiguration
2. TestReports
   a. WSP: Submit accepted ATP reports confirming the requirements ofthis specification have beenmet.
3. Field Reports: Submit sweep-testing results for all cableruns.
4. Operation and Maintenance Data: Submit hardware manuals forall Components.
5. WarrantyDocuments:
   a. Submit for all manufactured components specified in thisSection.
   b. Submit Contractor's SystemWarranty.
   c. Submit Manufacturer'sWarranty

1.09 QUALITYASSURANCE

A. Qualifications and Requirements:

1. Contractor or Sub-contractor shall have a minimum of 4-years full-time experience executing work of similar scope andcomplexity.
2. Contractor or Sub-contractor shall have deployed a minimum of 10 systems.
3. Contractor or Sub-contractor Project Managers must be SystemCertified.
4. Contractor or Sub-contractor shall provide an onsite constructionforeman to oversee theinstallation.
5. Contractor or Sub-contractor shall provide a project manager to oversee the deployment.

B. Certifications:

a. The manufacturer(s) of the active components shall maintain a

formal authorized and certified value-added reseller program,which consists of routine quality audits of the participating value-added resellers. The list of authorized value-added resellers shall be published and the Contractor or Sub-contractor shall be listed inthe Manufacturer's publication of value-addedresellers.

b. Contractor or Sub-contractor(s) shall provide manufacturer certification that their personnel have been trained on thepassive and active components beinginstalled.

c. Contractor or Sub-contractor shall be an authorized and certified value-added reseller for the proposed manufacturer of passive and activecomponents.

1.10 WARRANTY

A. ManufacturerWarranty:

1. Splitters, Couplers and Coverage Antennas: 5-year limited warrantyfrom date of systemacceptance.
2. Coaxial Cable and Connectors: 10-year limited warranty from dateof systemacceptance.
3. Active Components: The earliest of 3-year limited warranty from dateof system installation or 15 months from date ofshipment.

1.11 MAINTENANCE

A. The Contractor shall provide an optional annual maintenance service contractto include:

- Diagnostics & Repair
- 24x7x365 Technician Dispatch (On-site within 24hours)
- Annual PreventiveMaintenance
- Equipment Warranty Management

PART 2 – PRODUCTS

1.01 MANUFACTURERS

1. Specified Manufacturers for 50 Ohm passivecomponents:
   Wilson Electronics
   Specified Manufacturers for Active components: Wilson Electronics and Zinwave
2. Acceptable Manufacturers: Wilson Electronics Pro Series Equipment and Zinwave

1.02 COMPONENTS

CellularRepeater

Single Output Amplifier

A. Single Input Single Output (SISO) wall mount or rack mount cellular repeater shall provide up to +17 dBm downlink power and +26 dBm uplink power with maximum of 70dB gain that is compatible with all North American cellnetworks

B. The cellularrep

C. The cellular repeater shall incorporate eXtended Dynamic Range (XDR) technology to protect the amplifier from shutting down due to strongoutside signal (-40dBm or higher) or changes in the outsidesignals.

D. The cellular repeater shall incorporate Multi-Tower Targeting (MTT) technology to target specific frequency bands from multiple macroantennas.

E. The cellular repeater shall incorporate cloud integration for remote monitoring and management. Connectivity to the cloud shall be via LTE connection (using built-in cellular modem) or wired ethernetconnection.

F. The cellular repeater shall auto-detect and prevent any cell towerinterference.

G. Frequencies:

a.	Band12	700MHz
b.	Band13	700MHz
c.	Band5	850MHz
d.	Band4	1700/2100MHz
e.	Band25/2	1900MHz

Multiple Output Amplifier

A. Single Input Multiple Output (SIMO) wall mount or rack mount cellularrepeater shall provide up to +17 dBm downlink power and +26 dBm uplink power with maximum of 70dB gain from the input to each of (4) outputs and is compatible with all North American cellnetworks

B. The cellular repeater shall incorporate eXtended Dynamic Range (XDR) technology to protect the amplifier from shutting down due to strongoutside signal (-40dBm or higher) or changes in the outsidesignals.

C. The cellular repeater shall incorporate Multi-Tower Targeting (MTT) technology to target specific frequency bands from multiple macroantennas.

D. The cellular repeater shall incorporate cloud integration for remote monitoring and management. Connectivity to the cloud shall be via LTE connection (using built-in cellular modem) or wired ethernetconnection.

E. The cellular repeater shall display RSRP & RSRQ (network scanning) on the LCD referenced to the indoor (server) ports. This represents signal performance after it has been and amplified and shall also be available through cloud integration for troubleshooting purposes.

F. The cellular repeater shall auto-detect and prevent any cell towerinterference.

G. The solution shall have the capability of conversion to RF over fiber utilizing duplex singlemode fiber for backbone distribution and composite duplex singlemode fiber and 16/2 AWG copper for horizontal cabling to remoteunits.

H. Frequencies:

f.	Band12	700MHz
g.	Band13	700MHz
h.	Band5	850MHz
i.	Band4	1700/2100MHz
j.	Band25/2	1900MHz

Outside Antennas

I. Omni-Directional Outside Antennas: Omni-Directional outside antennas shall feature a multi-band design, accommodating multiple frequency bands in a single smallantenna.

J. Electrical Band1:
   k. Frequency Band: 698 – 800MHz
   l. VSWR: < 1.8
   m. Gain: 2dBi
   n. Maximum inputpower:100W
   o. Impedance: 50Ω
   p. Beamwidth, Horizontal: 360°omnidirectional
   q. Beamwidth, Vertical: 60°nominal

1. Electrical Band2:
   a. Frequency Band: 1710 – 2700 MHz and 800 – 960MHz
   b. VSWR:1.5:1
   c. Gain: 5dBi
   d. Maximum input power:100W
   e. Impedance: 50Ω
   f. Beamwidth, Horizontal: 360°omnidirectional
   g. Beamwidth, Vertical: 60°nominal

2. Mechanical:
   a. Connector: 50 Ω N TypeFemale
   b. Mounting: MastMountRadome material: ABS, UVresistant
   c. Pigtail cable: KSR195, plenumrated
3. Environmental:
   a. Application:Outdoor
   b. Operating Temperature: 40 °C to +60 °C (40 °F to +140°F)
   c. Relative Humidity: Up to100%
4. Regulatory Compliance/Certifications: RoHS2002/95/EC

Outside Directional Antennas (YAGI): Outside Directional antennas shallfeature a multi-band design, accommodating multiple frequency bands in a single small antenna.

K. Electrical Band1:
   a. Frequency Band: 698 – 800MHz
   b. VSWR: < 1.8
   c. Gain: 2dBi
   d. Maximum inputpower:100W
   e. Impedance: 50Ω
   f. Beamwidth, Horizontal: 360°omnidirectional
   g. Beamwidth, Vertical: 60°nominal

1. Electrical Band2:
   a. Frequency Band: 1710 – 2700 MHz and 800 – 960MHz
   b. VSWR:<1.8
   c. Gain: 4dBi
   d. Maximum input power:100W
   e. Impedance: 50Ω
   f. Beamwidth, Horizontal: 360° omnidirectional
   g. Beamwidth, Vertical: 60°nominal
2. Mechanical:
   a. Connector: 50 Ω N TypeFemale

b. Mounting: Thru-hole ceilingmount
c. Radome material: ABS, UVresistant
d. Pigtail cable: KSR195, plenumrated

3. Environmental:
   a. Application:Indoor
   b. Operating Temperature: 40 °C to +60 °C (40 °F to +140°F)
   c. Relative Humidity: Up to100%
4. Regulatory Compliance/Certifications: RoHS2002/95/EC

Inside Antennas

L. Omni-Directional Coverage: Omni-Directional Coverage antennas shall feature a multi-band design, accommodating multiple frequency bands in a singlesmall antenna.

M. Electrical Band1:
   a. Frequency Band: 698 – 800MHz
   b. VSWR: 1.5:1
   c. Gain: 7dBi
   d. Maximum input power: 50watts
   e. Impedance: 50Ω
   f. Beamwidth, Horizontal: 360°omnidirectional
   g. Beamwidth, Vertical: 60°nominal
   h. Return Loss: 10.9dB

1. Electrical Band2:
   a. Frequency Band: 1710 – 2700 MHz and 800 – 960MHz
   b. VSWR:1.5:1
   c. Gain: 7dBi
   d. Maximum input power: 50watts
   e. Impedance: 50Ω
   f. Beamwidth, Horizontal: 360°omnidirectional
   g. Beamwidth, Vertical: 65°nominal
   h. Return Loss: ≤ 13.9dB
2. Mechanical:
   a. Connector: 50 Ω N TypeFemale
   b. Mounting: Thru-hole ceilingmount
   c. Radome material: ABS, UVresistant
   d. Pigtail cable: KSR195, plenumrated
3. Environmental:
   a. Application:Indoor
   b. Operating Temperature: 40 °C to +60 °C (40 °F to +140°F)
   c. Relative Humidity: Up to100%
4. Regulatory Compliance/Certifications: RoHS2002/95/EC

N. Low Profile Omni-Directional Coverage: Omni-Directional Coverage antennas shall feature a multi-band design, accommodating multiple frequency bands ina single smallantenna.

O. Electrical Band1:
   i. Frequency Band: 698 – 800MHz
   j. VSWR: 1.5:1
   k. Gain: 7dBi
   l. Maximum input power: 50watts

m. Impedance: 50Ω
n. Beamwidth, Horizontal: 360°omnidirectional
o. Beamwidth, Vertical: 60°nominal
p. Return Loss: 10.9dB

1. Electrical Band2:
   i. Frequency Band: 1710 – 2700 MHz and 800 – 960MHz
   j. VSWR:1.5:1
   k. Gain: 7dBi
   l. Maximum input power: 50watts
   m. Impedance: 50Ω
   n. Beamwidth, Horizontal: 360°omnidirectional
   o. Beamwidth, Vertical: 65°nominal
   p. Return Loss: ≤ 13.9dB
2. Mechanical:
   e. Connector: 50 Ω N TypeFemale
   f. Mounting: Thru-hole ceilingmount
   g. Radome material: ABS, UVresistant
   h. Pigtail cable: KSR195, plenumrated
3. Environmental:
   d. Application:Indoor
   e. Operating Temperature: 40 °C to +60 °C (40 °F to +140°F)
   f. Relative Humidity: Up to100%
4. Regulatory Compliance/Certifications: RoHS2002/95/EC

P. Directional Coverage Antennas: Directional coverage antennas shall featurea multi-band design, accommodating multiple frequency bands in a single small antenna.

1. Electrical Band1:
   a. Frequency Band: 698 – 800MHz
   b. VSWR: 1.5:1
   c. Gain: ≥ 5.0 dBi @ 698 – 800MHz
   d. Maximum input power:50W
   e. Impedance: 50Ω
   f. Beamwidth, Horizontal:70/60°
   g. Polarization:Vertical
   h. Return Loss: ≤ 10.9dB
2. Electrical Band2:
   a. Frequency Band: 1710 – 2700 MHz and 800 – 960MHz
   b. VSWR: ≤1.5:1
   c. Gain: ≥ 5.0 dBi @ 800 – 960 MHz and ≥ 8.0 dBi @ 1710 – 2170 MHz
   d. Maximum input power:50W
   e. Impedance: 50Ω
   f. Beamwidth, Horizontal:70/60°
   g. Return Loss: ≤ 13.9dB
3. Mechanical:
   a. Connector: 50 Ω N TypeFemale
   b. Mounting: 4-hole wall mountingplate
   c. Radome material: ABS, UVresistant
   d. Pigtail cable: RG58, plenumrated

4. Environmental:
    a. Application:Indoor
    b. Operating Temperature: 40 °C to +60 °C (40 °F to +140°F)
    c. Relative Humidity: Up to100%
5. Regulatory Compliance/Certifications: RoHS2002/95/EC

Q. Air Dielectric, Plenum RatedCable:

1. MaterialCharacteristics:
    a. Jacket: Halogenated,Fire-Retardant
    b. Outer Conductor Material: Corrugated Aluminum orCorrugated Copper
    c. Inner Conductor Material: Copper-Clad AluminumWire
2. ElectricalCharacteristics:
    a. Impedance: 50 ± 2.0Ω
    b. Frequency Band: 1 - 8800MHz
    c. Peak Power Rating: ≥ 40.0kW
3. MechanicalCharacteristics:
    a. Diameter Over Jacket: ≤ .627in
    b. Minimum Bending Radius: ≤ 5in
    c. One Time Minimum Bending Radius: ≤ 3in
4. AttenuationCharacteristics:

Frequency (MHz)	Attenuation (dB/100ft)
150	≤ 0.848
450	≤ 1.53
800	≤ 2.105
2000	≤ 3.564

Standard Conditions: VSWR 1.0, ambient temperature 20 °C (68 °F)

R. Foam DielectricCable:

1. MaterialCharacteristics:
    a. Jacket: Non-halogenated, Fire-RetardantPloyolefin
    b. Outer Conductor Material: CorrugatedCopper
    c. Inner Conductor Material: Copper-Clad Aluminum Wire orCopper Tube
2. ElectricalCharacteristics:
    a. Impedance: 50 ± 1.0Ω
    b. Frequency Band: 1/2” Nominal: 1 - 8800 MHz, 7/8” Nominal: 1- 5000 MHz
    c. Peak Power Rating: ≥ 40.0kW
3. MechanicalCharacteristics:
    a. Diameter Over Jacket: 1/2” Nominal: ≤ .630 in, 7/8” Nominal:≤ 1.1 in
    b. Minimum Bending Radius: 1/2” Nominal: ≤ 5 in, 7/8” Nominal: ≤10 in
    c. One Time Minimum Bending Radius: 1/2” Nominal: ≤ 2 in,7/8” Nominal: ≤ 5in
4. Attenuation Characteristics: 1/2”Nominal

Frequency (MHz)	Attenuation (dB/100ft)
150	≤ 0.815
450	≤ 1.447
800	≤ 1.968
2000	≤ 3.251

Standard Conditions: VSWR 1.0, ambient temperature 20 °C (68°F)

5. Attenuation Characteristics: 7/8”Nominal:

Frequency (MHz)	Attenuation (dB/100ft)
150	≤ 0.417
450	≤ .744
800	≤ 1.014
2000	≤ 1.683

Standard Conditions: VSWR 1.0, ambient temperature 20 °C (68 °F)

S. Splitters, Taps, Couplers, and CoaxJumpers:
1. Approved Manufacturer: WilsonElectronics

PART 3 – EXECUTION

3.01 INSTALLATION

A. The contractor and/or Sub-contractor shall design, install, commission andtest the Cellular amplification system in accordance with the manufacturer’s instructions andrecommendations.

B. The contractor and/or Sub-contractor shall install the Cellular amplification system in accordance with the acceptedSOW.

C. The contractor and/or Sub-contractor shall adhere to all work andsafety requirements while working at the jobsite.

D. The contractor and/or Sub-contractor shall have Cellular amplification system project foreman on site overseeing theinstallation.

E. The contractor and/or Sub-contractor shall have at a minimum oneProject Manager on staff overseeing the project. The Project Manager will be responsible for thefollowing:
1. Developing and maintaining a project plan consistent with theoverall milestones of theproject.
2. Overseeing and coordinating the activities of the Cellular amplification system project, including: initiating and holding weekly projectconference calls, as well as maintaining and distributing meetingminutes.
3. Act as the point-of-contact interface for all Cellular amplificationsystem projectactivities.
4. Provide weekly status updates regarding work performed,worked scheduled, open items, problems/issues andresolutions.

F. The contractor and Sub-contractor shall be prepared to deploy the

Cellular amplification system in a phased approached as dictated by the building construction and/or work of othertrades.

G. The contractor and Sub-contractor shall be WilsonProCertified

H. All singlemode fiber connections shall be SC/ APC. No mechanicalterminations. Fusion splicingonly.

I. No more than 5dB optical loss and 35dB back reflection per opticallink.

J. The contractor and Sub-contractor shall facilitate WSP registration and connection to their respective macronetworks.

K. The contractor and Sub-contractor shall be prepared to connect to the WSP's network(s) in a phased approached as dictated by the constructionschedules.

L. Install cabling designed for the environment the cable will be installedin.

M. Terminate and test all coaxial cabling with a sweepanalyzer.

N. Test all fiber cabling utilizing level 3 tester orabove

O. Label all cabling per the contract drawings to indicate the segment numberfrom eachamplifier.

P. Provide exterior cell measurements according to themanufacturers recommendations.

3.02 ACCEPTANCETESTING

A. Acceptance testing will be performed confirming the requirements ofSection 1.07 have been met.

B. The contractor shall complete the acceptance testing per the requirementsand as prescribed in the approved Acceptance Test Plan (ATP)submittal.

C. Acceptance Testing

1. Acceptance Testing shall comply with thefollowing:
   a. The Acceptance Test shall ensure that two-way coverage on eachfloor of the building meets the minimum coverage requirements detailed in Section1.07.
   b. Tests shall be made using the frequencies listed in Section1.02.A.
   c. Testing shall be coordinated with the Customer and AHJ to ensureno undue interference to any buildingoperations.
   d. All testing shall be done on frequencies authorized by theFCC.

2. TestProcedures

   The test plan shall ensure testing throughout the building. Testing shall be performed on a grid system. A spot located approximately in the center of a grid area will be selected for the test. Once the spot has been selected, prospecting for a better spot within the grid area will not be permitted. A grid is overlaid onto a floor area to provide 20 grid cells. Grid cells are provided with definite minimum and maximum dimensions. For most buildings, using a minimum grid dimension of 20 ft and a maximum grid dimension of 80 ft will suffice to encompass the entire floor area. A maximum of one area will be allowed to fail the test (95% coverage).

   Where a floor exceeds the sq ft, which is the floor area that can be covered by the system, the floor be subdivided into 40 equal sectors, with each

sector being tested individually. A maximum of two non-adjacent areas will be allowed to fail the test (95% coverage). In addition to the above requirement, all critical areas, which include; the emergency command center(s), the fire pump room(s), exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations, and other areas deemed critical by the AHJ, shall be provided with 99 percent floor area radio coverage. Signal strength measurements shall be performed using standardized parameters as specified below.

3. MeasurementParameters

Signal levels shall be measured to ensure the system meets the criteria specified in the Technical Proposal. Downlink measurements shall be made with the following standardized parameters:

1. Measurements shall be recorded using a calibrated automatic signal-level measurement system measuring RSRP in each band with adipole antenna positioned approximately 4’ above thesurface.
2. Measurements will be recorded for the test pattern as describedabove.
3. System acceptance is achieved when 95% of the averaged datapoints meet or exceed the requirements specified here and in Section1.07.

END OF SECTION

SECTION 28 00 00

VIDEO SURVEILLANCE

PART 1 GENERAL

1.01 SYSTEM DESCRIPTION

A. General Requirements

1. The specified unit shall be of manufacturer's official product line, designed for commercial and/or industrial 24/7/365 use.
2. The specified unit shall be based upon standard components and proven technology using open and published protocols.
3. This will be a turn-key video surveillance system including all components per equipment and software schedule per item 2.02. The NVR should be calculated for a 50% growth and for at least 90-day retention period at 5 fps for 24 hours recording devices and 30 fps for motion and alarm based recording and full resolution.
4. All equipment and software will be housed in the network enclosure at the MDF location.

B. Sustainability

1. The specified unit shall be manufactured in accordance with ISO 14001.
2. The specified unit shall be compliant with the EU directives 2011/65/EU (RoHS) and 2012/19/EU (WEEE).
3. The specified unit shall be compliant with the EU regulation 1907/2006 (REACH).
4. The specified unit shall be PVC-free in accordance with IEC 61249-2-21.

1.02 CERTIFICATIONS AND STANDARDS

A. General abbreviations and acronyms

1. AGC: Automatic gain control
2. API: Application Programming Interface
3. Aspect ratio: A ratio of width to height in images
4. Bit Rate: The number of bits/time unit sent over a network
5. Bonjour: Enables automatic discovery of computers, devices, and services on IP networks.
6. DHCP: Dynamic Host Configuration Protocol
7. DNS: Domain Name System
8. EIS: Electronic Image Stabilization
9. FPS: Frames per Second
10. FTP: File Transfer Protocol
11. H.264 (Video Compression Format)
12. IEEE 802.1x: Authentication framework for network devices
13. IP: Internet Protocol
14. IR light: Infrared light
15. JPEG: Joint Photographic Experts Group (image format)

16. LAN: Local Area Network
17. LED: Light Emitting Diode
18. Lux: A standard unit of illumination measurement
19. MPEG: Moving Picture Experts Group
20. Multicast: Communication between a single sender and multiple receivers on a network
21. NTP: Network Time Protocol
22. NTSC: National Television System Committee – a color encoding system based on 60Hz
23. ONVIF: Global standard for the interface of IP-based physical security products
24. PAL: Phase Alternating Line – a color encoding system based on 50Hz
25. PoE: Power over Ethernet (IEEE 802.3af/at) standard for providing power over network cable
26. Progressive scan: An image scanning technology which scans the entire picture
27. PTZ: Pan/Tilt/Zoom
28. QoS: Quality of Service
29. SMTP: Simple Mail Transfer Protocol
30. SMPTE: Society of Motion Picture and Television Engineers
31. SNMP: Simple Network Management Protocol
32. SSL: Secure Sockets Layer
33. TCP: Transmission Control Protocol
34. TLS: Transport Layer Security
35. Unicast: Communication between a single sender and single receiver on a network
36. UPnP: Universal Plug and Play
37. UPS: Uninterruptible Power Supply
38. VMS: Video Management System
39. WDR: Wide dynamic range

B. The specified unit shall carry the following EMC approvals:
1. EN55022 Class B, EN55024, EN61000-6-1, EN61000-6-2
2. FCC Part 15 - Subpart B Class B
3. VCCI Class B
4. C-tick AS/NZS CISPR22 Class B
5. ICES-003 Class B
6. KCC KN22 Class B, KN24

C. The specified unit shall meet the following product safety standards:
1. IEC/EN/UL 60950 -1
2. IEC/EN/UL 60950 -22

D. The specified unit shall meet relevant parts of the following video standards:
1. SMPTE 296M (HDTV 720p)
2. SMPTE 274M (HDTV 1080p)

E. The specified unit shall meet the following standards
1. MPEG-4:
    a. ISO/IEC 14496-10 Advanced Video Coding (H.264)
2. Networking:

a. IEEE 802.3af/802.3at (Power over Ethernet)
b. IEEE 802.1X (Authentication)
c. IPv4 (RFC 791)
d. IPv6 (RFC 2460)
e. QoS – DiffServ (RFC 2475)

3. Network video
   a. Relevant ONVIF profile as defined by the ONVIF Organization.
4. Mechanical Environment:
   a. IEC 60529 IP66
   b. NEMA 250 Type 4X
   c. IEC 62262 IK10
   d. IEC 60068-2-1
   e. IEC 60068-2-2
   f. IEC 60068-2-14
   g. IEC 60068-2-27
   h. IEC 60068-2-30
   i. IEC 60068-2-64
   j. IEC 60068-2-78
5. Railway environment:
   a. EN 50121-4
   b. IEC 62236-4

1.03 QUALITY ASSURANCE

A. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of five (5) years' experience installing and servicing systems of similar scope and complexity and evidence that is completed at least three (3) projects of similar design and is currently engaged in the installation and maintenance of systems herein described.

B. All camera installation, configuration, setup, program and related work shall be performed by electronic technicians thoroughly trained by the manufacturer in the installation and service of the equipment provided.

C. The contractor or designated sub-contractor shall submit credentials of completed manufacturer certification, verified by a third-party organization, as proof of the knowledge.

D. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity that became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system

E. The specified unit shall be manufactured in accordance with ISO9001.

1.04 WARRANTY

A. All security system components and labor furnished by the contractor including wiring, software, hardware and custom parts shall be fully warranted for parts, materials, labor and travel expenses for a minimum of three (3) years from date of the final acceptance of the Video Surveillance System.

B. The manufacturer shall provide warranty and optional extended warranty for the camera for a total period of maximum five years. If enacted as part of the contract, the contractor will repair or replace parts and/or labor per the warranty for the length of this warranty at no cost to the client.

PART 2 PRODUCTS

2.01 GENERAL

A. Cameras shall be IP-based and comply with established network and video standards.

B. Cameras shall be powered by the switch utilizing the network cable. Power injectors (midspans) shall be provided by the contractor when required for proper operation.

C. Cameras shall be fully supported by an open and published API (Application Programmers Interface), which shall provide necessary information for integration of functionality into third party applications.

D. Cameras shall comply with relevant ONVIF profile as defined by the ONVIF Organization.

2.02 VIDEO SURVEILLANCE SCHEDULE

A. Camera types listed below describing various resolutions, form-factor and features shall be supplied by a single camera manufacturer video surveillance system.

B. The camera equipment and software model numbers to be utilized as a basis of design will be as follows:

1. Fixed Indoor Camera: AXIS P3265-V
2. Fixed Outdoor Camera: AXIS P3265-LVE
3. Panoramic Indoor Camera: AXIS P3715-PLVE
4. PTZ Camera: AXIS Q6315-LE
5. Surge protectors for outdoor cameras: AXIS T8061
6. Network audio module: AXIS P8221.
7. Microphone: AXIS T83.
8. PoE Extenders for cameras exceeding 300 ft: Use Commscope Fiber powered cabling system including power supplies and fiber composite cable.
9. Mounting accessories to be provided based on the locations marked in the construction drawings.
10. VMS Software: exacqVision Enterprise. Include 3-years maintenance.
11. Video Surveillance Server: DELL PowerEdge R640. Provide DELL KVM and NAS Repository. Server must be sized to have at least 90-day retention video for surveillance cameras. This server will be shared with the Access Control Section 281300.

C. Exterior 5Mpxl vandal-resistant network dome camera

1. The network dome camera shall meet or exceed the following design specifications:

a. The camera shall operate on an open source; Linux-based platform and including a built-in web server.
b. The camera shall be equipped with an IR-sensitive progressive scan sensor.
c. The camera shall provide a removable IR-cut filter, providing day/night functionality.
d. The camera shall be equipped with a varifocal lens with P-iris.
e. The camera shall provide local video storage utilizing a SD/SDHC/SDXC memory card expansion, supporting memory up to 64 GB.
f. The camera shall be manufactured with an IP66- and NEMA 4X-rated, IK10 impact-resistant outdoor casing.
g. The camera shall provide a manual 3-axis (pan/tilt/rotation) positioning to allow adjustment for optimum camera rotation and placement.

2. The network dome camera shall meet or exceed the following performance specifications:
   a. Illumination
      1. The camera shall meet or exceed the following illumination specifications:
         a. Color: 0.2 lux B/W: 0.04 lux
   b. Resolution
      1. The camera shall Be designed to provide streams up to 2592x1944 pixels resolution at up to 12 frames per second using H.264 or Motion JPEG, and provide video streams in HDTV 1080p (1920x1080) at up to 30 frames per second using H.264 or Motion JPEG.
      2. The camera shall support video resolutions including:
         a. 2592x1944
         b. 1920x1080 (HDTV 1080p)
         c. 1280x720 (HDTV 720p)
         d. 1024x768
         e. 800x600
         f. 640x480
      3. The camera shall provide both landscape format (4:3 and 16:9 aspect ratio) as well as corridor format (3:4 and 9:16 aspect ratio).
   c. Encoding
      1. The camera shall support the following video encoding algorithms:
         a. Support Motion JPEG encoding in a selectable range from 1 up to 12 frames per second in all resolutions up to 2592x1944 pixels.
         b. Support Motion JPEG encoding in up to 30 frames per second in HDTV 1080p (1920x1080 resolution).
         c. Support Baseline Profile H.264 encoding with motion estimation in a selectable range from 1 up to 12 frames per second in all resolutions up to 2592x1944 pixels.
         d. Support Baseline Profile H.264 encoding with motion estimation in up to 30 frames per second in HDTV 1080p (1920x1080 resolution).
         e. Support Main Profile H.264 encoding with motion estimation and context-adaptive binary arithmetic coding (CABAC) in a selectable range from 1 up to 12 frames per second in all resolutions up to 2592x1944 pixels.
         f. Support Main Profile H.264 encoding with motion estimation and context-adaptive binary arithmetic coding (CABAC) in up to 30 frames per second in HDTV 1080p (1920x1080 resolution).
      2. The camera shall provide independently configured simultaneous H.264 and Motion JPEG streams.
      3. The camera shall support both Constant Bit Rate (CBR) and Variable Bit Rate (VBR) in H.264.
      4. The camera shall provide configurable compression levels.
      5. Support motion estimation in H.264/MPEG-4 Part 10/AVC.

d. Transmission
1. The camera shall allow for video to be transported over:
a. HTTP (Unicast)
b. HTTPS (Unicast)
c. RTP (Unicast & Multicast)
d. RTP over RTSP (Unicast)
e. RTP over RTSP over HTTP (Unicast)
2. The camera shall support Quality of Service (QoS) to be able to prioritize traffic.

e. Image
a. The camera shall incorporate Automatic and Manual White Balance
b. The camera shall be equipped with an electronic shutter.
c. The camera shall incorporate automatic and manually defined exposure zones.
d. The camera shall support a configurable maximum shutter in the range:
1. 5 MP capture mode: 1/24000 s to 2 s
2. 3 MP capture mode: 1/30050 s to 2 s
3. HDTV 1080p (1920x1080) capture mode: 1/34500 s to 2 s
4. 2 MP 4:3 (1600x1200) capture mode: 1/35500 s to 2 s
e. The camera shall be equipped with Wide Dynamic Range functionality - dynamic contrast.
f. The camera shall provide backlight compensation.
g. The camera shall allow for rotation of the image in steps of 90º.
h. The camera shall support manually defined values for:
1. Color level
2. Brightness
3. Sharpness
4. Contrast
i. The camera shall incorporate a function for optimization of low light behavior.

f. Audio
1. The camera shall support two-way full duplex audio:
2. Input sources
a. External microphone
b. External line device
3. Output sources
a. External line device
4. Encoding
a. The camera shall support:
1. AAC LC at 8/16 kHz
2. G.711 PCM at 8 kHz
3. G.726 ADPCM at 8 kHz

g. User Interface
1. Web server
a. The camera shall contain a built-in web server making video and configuration available to multiple clients in a standard operating system and browser environment using HTTP, without the need for additional software.

b. Optional components downloaded from the camera for specific tasks, e.g. Active X, shall be signed by an organization providing digital trust services, such as Verisign, Inc.

2. IP addresses

a. The camera shall support both fixed IP addresses and dynamically assigned IP addresses provided by a Dynamic Host Control Protocol (DHCP) server.

b. The camera shall allow for automatic detection of the camera based on UPnP and Bonjour when using a PC with an operating system supporting this feature.

c. The camera shall provide support for both IPv4 and IPv6.

h. PTZ functionality

1. The camera shall:

a. Provide Digital PTZ functionality.

i. Event functionality

1. The camera shall be equipped with an integrated event functionality, which can be trigged by:

a. External input

b. Video Motion Detection

c. Audio Detection

d. Schedule

e. Camera tampering

f. Local storage full

2. Response to triggers shall include:

a. Notification, using TCP, SMTP or HTTP

b. Image upload, using FTP, SMTP or HTTP

c. Activating external output

d. Play audio clip

e. Recording to local storage

3. The camera shall provide memory for pre & post alarm recordings.

j. Edge storage

1. The camera shall support continuous and event controlled recording to:

a. Local memory added to the cameras SD-card slot

b. Network attached storage, located on the local network

2. The camera shall be able to detect and notify Edge storage disruptions.

k. Protocol

1. The camera shall incorporate support for at least IPv4/v6, HTTP, HTTPS, SSL/TLS, TCP, ICMP, SNMPv1/v2c/v3 (MIB-II), RTSP, RTP, UDP, IGMP, RTCP, SMTP, FTP, DHCP, UPnP, ARP, DNS, DynDNS, SOCKS, NTP and Bonjour.

2. The SMTP implementation shall include support for SMTP authentication.

l. Text overlay

1. The camera shall:

a. Provide embedded on-screen text with support for date & time, and a customer-specific text, camera name, of at least 45 ASCII characters.

b. To ensure accuracy, the camera shall accept external time synchronization from an NTP (Network Time Protocol) server.

c. Provide the ability to apply privacy masks to the image.

d. Allow for the overlay of a graphical image, such as a logotype, into the image.

m. Security

1. The camera shall support the use of HTTPS and SSL/TLS, providing the ability to upload signed certificates to encrypt and secure authentication and communication of both administration data and video streams.
2. The camera shall support IEEE 802.1X authentication.
3. The camera shall provide support for restricting access to pre-defined IP addresses only, so-called IP address filtering.
4. The camera shall restrict access to the built-in web server by usernames and passwords at three different levels.

n. API support

1. The camera shall be fully supported by an open and published API (Application Programmers Interface), which shall provide necessary information for integration of functionality into third party applications.
2. The camera shall support relevant ONVIF profiles as defined by the ONVIF Organization.

o. Embedded applications

1. The camera shall provide a platform allowing the upload of third party applications into the camera.

p. Installation and maintenance

1. The camera shall be supplied with Windows-based management software which allows the assignment of IP addresses, upgrade of firmware and backup of the cameras' configuration.
2. The camera shall support the use of SNMP-based management tools according to SNMP v1, 2c & 3 / MIB-II.
3. The camera shall allow updates of the software (firmware) over the network, using FTP or HTTP.
4. The camera shall provide the ability to apply a rectangle of customer-defined number of pixels to the image, which can be used as a pixel counter identifying the size of objects in number of pixels.
5. The camera shall store all customer-specific settings in a non-volatile memory that shall not be lost during power cuts or soft reset.

q. Access log

1. The camera shall provide a log file, containing information about the 250 latest connections and access attempts since the unit's latest restart. The file shall include information about the connecting IP addresses and the time of connecting.
2. Provide a connection list of all currently connected viewers. The file shall include information about connecting IP address, time of connecting and the type of stream accessed.

r. Camera diagnostics

1. The camera shall be equipped with LEDs, capable of providing visible status information. LEDs shall indicate the camera's operational status and provide information about power, communication with receiver, the network status and the camera status.
2. The camera shall be monitored by a Watchdog functionality, which shall automatically re-initiate processes or restart the unit if a malfunction is detected.

s. Hardware interfaces

1. Network interface
   a. The camera shall be equipped with one 100BASE-TX Fast Ethernet-port, using a standard RJ-45 socket and shall support auto negotiation of network speed (100 MBit/s and 10 MBit/s) and transfer mode (full and half duplex).
2. Inputs/Outputs
   a. The camera shall be equipped with one digital (alarm) input and one digital output, accessible via a removable terminal block. This input shall be configurable to respond to normally open (NO) or normally closed (NC) dry contacts.
3. Audio

a. The camera shall be equipped with one 3.5 mm jack for line/mic input and one 3.5 mm jack for line output.

t. Enclosure

1. The camera shall camera shall be manufactured with an IK10 impact-resistant aluminum casing.

u. Power

1. Power over Ethernet IEEE 802.3af/802.3at Type 1 Class 3

v. Environmental

1. Operate in a temperature range of -40 °C to +55 °C (-40 °F to 131 °F).
2. Operate in a humidity range of 10–100% RH (condensing).

PART 3 EXECUTION

3.01 INSTALLATION

A. The Contractors or subcontractors main resources within the project shall carry proper professional certification issued by the manufacturer and verified by a third party organization to confirm sufficient product and technology knowledge.

B. The Contractor shall carefully follow instructions in documentation provided by the manufacturer to ensure all steps have been taken to provide a reliable, easy-to-operate system.

C. All equipment shall be tested and configured in accordance with instructions provided by the manufacturer prior to installation.

D. All firmware found in products shall be the latest and most up-to-date provided by the manufacturer, or of a version as specified by the provider of the Video Management Application (VMA) or Network Video Recorder (NVR).

E. All equipment requiring users to log on using a password shall be configured with user/site-specific password/passwords. No system/product default passwords shall be allowed.

F. A proper installation shall meet NEC (National Electrical Code – US only) per the guidelines of that year's revision. When properly installed equipment meets Low Voltage, Class 2 classification of the NEC.

END OF SECTION

SECTION 28 31 00

INTRUSION / ACCESS INTEGRATED SYSTEM

1.0 GENERAL

1.1 Manufacturer

A. The manufacturer shall have at least thirty-five (35) years of experience in the role of fire and security control manufacturing, and a proven track record of forward and backward compatibility for a minimum of twenty (25) years for its product's auxiliary devices, including system keypads, annunciation devices, zone expansion modules, and addressable detection devices.

B. The manufacturer must also manufacture receiving equipment that is compatible with standard dial-up telephone lines, network, and cellular network monitoring equipment that is compatible with a LAN, WAN, and the Internet. The receiving equipment shall be capable of receiving all status and alarm messages generated by the system. The receiving equipment shall be capable of updating the panel operating program and the system date and time.

C. Commercial Intrusion detection/Access control /Household Fire Alarm Control Panel equipment manufacturer shall be:

Digital Monitoring Products, Incorporated (DMP) #DMP XR550N

2500 N. Partnership Boulevard, Springfield, MO 65803

Telephone (417) 831-9362FAX (417) 831-1325

1.2 Installer

A. The installing company shall show proof of having regular experience with design, installation, service, and maintenance of manufactured systems for a minimum of the last twelve (12) calendar months from the project start date. Each system installer and service person must provide manufacturer certification of technical training for installation, service, and system maintenance. Certification shall be proven with an official document issued by the manufacturer.

B. The installing company shall provide a minimum of 8 (eight) verifiable references from its clients where the manufacturer's system has been installed within the last twelve (12) calendar months from the project start date.

C. The installing company shall furnish and install a complete electrically supervised DMP panel, as detailed in this specification. The system shall be inclusive of all necessary function, monitoring, and control capability as detailed herein and on accompanying shop drawings.

E. The installing company shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Architect of any discrepancy before performing the work. Materials shall be installed in strict compliance with local building codes. All work shall be performed in accordance with Digital Monitoring Products, Inc. instructions. Components must be installed and serviced by a dealer in good standing that is factory-trained by Digital Monitoring Products.

1.3 Central Reporting Station

A. The central reporting station contractor must possess an Underwriter's Laboratory (UL) listing as a "Mercantile Police Station" or "Mercantile Burglar Alarm Systems" company. A copy of the listing shall be attached as a part of this bid package.

B. The actual alarm signal receipt and processing is a significant portion of the scope of work. Third party and/or contract stations are permitted. UL must list the monitoring station for Protective Signaling Services or Central Reporting Station Signaling Services. A copy of the station UL listing shall be attached as part of this bid package.

C. The monitoring station must provide openings/closing activity reports, activity day and time, authorized individual, office name and account number and the system type being monitored. These reports are to be mailed to the user's office at the end of each month. The Office Manager or Contract Administrator may request an additional report if an incident occurs.

D. The contractor must have a valid Alarm Operator License. A copy of licenses shall be attached as part of this bid package.

E. The contractor may be required to monitor a portion of the alarm systems by way of the end user data network.

F. The contractor shall become familiar with all work details, verify all dimensions in the field, and shall advise the Architect of any discrepancy before performing the work.

G. The end user shall not incur any central station setup charges by the contractor to receive alarm signals by way of the end user data network.

2.0 SCOPE

2.1 Requirements

A. Furnish and install a complete Intrusion Detection/Access Control system with the performance criteria detailed in this specification. The system shall be inclusive of all necessary functions, monitoring, and control capability as detailed herein and on accompanying Shop drawings.

- On-site or remote video monitoring
- Heating, air conditioning, and lighting management
- Temperature threshold detection and monitoring
- Humidity threshold detection and monitoring
- Pressure threshold detection and monitoring
- Power loss detection and monitoring, generator switching
- Leak detection and monitoring
- Carbon Monoxide detection and monitoring
- Tank level threshold detection and monitoring

B. This specification document provides the requirements for the installation, programming, and configuration of a complete DMP panel. This system shall include, but not be limited to:

- Control panel
- System cabinet
- Power supply
- Digital Signaling Line Circuits (SLC)
- Notification Appliance Circuits (NAC)
- Annunciator/keypad bus
- Batteries
- Wiring
- Conduit
- Associated peripheral devices
- Other relevant components and accessories required to furnish and install a complete and operational addressable reporting Life Safety System.

2.2 Standards

The system shall be listed as a Power Limited Device and be listed under the standards below. Each system shall be supplied with complete details on all installation criteria necessary to meet all of the listings.

Burglary Listings	**U.S. Government Standards/Listings**
UL 1023 Household Burglar Alarm System Units	Meets ICD 705 Chapter 7 Intrusion Detection Systems (IDS)
UL 1076 Proprietary Burglar	Meets DoD/NIST SCIF Standards
UL 1610 Central Station Burglar Alarm Units	**Related Standards**
UL 1635 Digital Burglar Alarm Communicator System	NFPA 70 National Electric Code (NEC)

Units	
Fire Listings	NFPA 72 Local Protective Signaling
UL 864 Control Units for Fire Protective Signaling Systems	NFPA 72 Remote Station Protective Signaling
UL 985 Household Fire Warning	NFPA 72 Proprietary Protective Signaling
California State Fire Marshal	NFPA 72 Household Fire Warning
New York City FDNY COA #6167	**Canadian Burglary Listings**
Access Control Listings	ULC C1023 Household Burglar
UL 294 Access Control System Units	ULC/ORD-C1076 Proprietary Burglar
NIST	ULC S304 Central Station Burglar
AES Algorithm Certificate #2350 128	**Canadian Fire Listings**
AES Algorithm Certificate #2595 256	ULC S545 Household Fire
	ULC S559 Fire Signal Receiving Centres and Systems

2.3 Americans with Disabilities

All indicating and notification appliances shall comply with the Americans with Disabilities Act (ADA) requirements.

3.0 SUBMITTALS

3.1 General Requirements

The contractor shall submit three (3) complete sets of documentation within thirty (30) calendar days after contract award date. Indicated in the document shall be the manufacturers' names, catalog number, type, size, style, rating, and catalog data sheets for all items proposed to meet these specifications.

3.2 Shop Drawings

Shop drawings shall be submitted in accordance with Section 3.0 Submittals and shall consist of a complete list of equipment and materials, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions.

3.3 As-Built Drawings

The contractor shall provide a complete set of as-built drawings for the entire system upon installation completion. These drawings shall include, but not be limited to, the exact locations of all equipment, connections between all equipment, and wiring for all equipment as the system is installed.

3.4 Spare Parts Data

After shop drawings are approved, and not later than thirty (30) calendar days prior to the date of beneficial occupancy, a list of spare parts data for each item of specified materials and equipment shall be submitted. The data shall include a complete list of parts and supplies with current unit prices and source of supply. Spare parts shall consist of, but not be limited to, five (5) percent of all initiating and notification appliances with a minimum of one (1) each. All spare parts shall be on site prior to commencement of acceptance testing. Depleted spare parts shall be replaced prior to beneficial occupancy.

3.5 Operating Documents

The contractor shall furnish to the architect operating instructions outlining the step-by-step procedures required for system start-up, operation, and shutdown at least thirty (30) calendar days prior to acceptance test. The instructions shall include the manufacturer's name, system model number, service manual, parts list, and a description of all equipment and their basic operating features.

3.6 Maintenance Documents

The contractor shall furnish maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides at least 30 calendar days prior to acceptance test.

3.7 Performance Test Reports

Upon the installed system completion and testing, test reports shall be submitted in booklet form showing all field tests performed to prove compliance with specified performance criteria.

3.8 Warranty

A copy of the manufacturer's warranty for all equipment and materials shall be provided. Warranty shall be for all equipment, materials, installation, and workmanship for a minimum of three (3) years, unless otherwise specified.

4.0 GENERAL COMPONENT REQUIREMENTS

4.1. Component Enclosure

Housings; power supply enclosures, terminal cabinets, control units, and other component housings, collectively referred to as enclosures shall be so formed and assembled as to be sturdy and rigid. If sheet steel is used in the fabrication of enclosures, it shall be not less than an 18 gauge door with a 20 gauge box frame. Where exposed pins, the hinges shall be of the tight pin type or the ends of hinge pins shall be tack welded to prevent ready removal. Doors having a latch edge length of less than 24 inches shall be provided with a single lock. Where the hinged door latch edge is 24 inches or more in length, doors shall be provided with three-point latching device with lock; or alternatively with two locks, one located near each end. For SCIF and High Security applications an attack proof enclosure with proper tampers listed for use with the XR150/XR350/XR550 with Network and Encryption shall be used.

4.2 Electronic Components

A. All system electronic components shall be solid-state type, mounted on printed circuit boards. Light duty relays and similar switching devices shall be solid-state type or electromechanical.

B. The panel shall have an over current notification LED that lights when devices connected to the Keypad Bus and Loop Expansion LX-Bus(es) draw more current than the panel is rated for. When the over current LED lights, the Loop Expansion LX-Bus(es) and Keypad bus are shut down.

4.3 Control Unit

A. A battery test shall be automatically performed to test the integrity of the standby battery. The test shall disconnect the standby battery from the charging circuit and place a load on the battery. This test shall be performed no more than every 180 seconds.

B. The control unit shall be capable of operating and supervising notification appliance devices as well as addressable initiating detection devices and an integrated supervised dual line digital communicator.

C. Control unit must be "Flash ROM" updatable, and program must be held in non-volatile RAM. The panel shall be able to function while the update is in process.

D. Control unit shall be capable of operating using an optional built in Encrypted Alarm Router for SCIF (Sensitive Compartmented Information Facility) application that is certified by NIST (National Institute of Standards and Technology) for 128-bit or 256-bit AES (Advanced Encryption Standard) Encryption communications.

E. The optional built-in Encrypted Alarm Router shall be capable of compliance with ICD 705 Chapter 7 Intrusion Detection Systems (IDS) and UL 2050 standards.

4.4 Remote Annunciators

A. The system shall support a maximum of sixteen (16) supervised remote annunciators with the identical capabilities, functions and display layout. Operation of the remote annunciators shall be limited to authorized users by the use of a code or key.

B. The remote annunciators shall be capable of operating at a maximum wiring distance of 15,000 feet from the control unit on unshielded, non-twisted cable.

4.5 Control Designations

Controls shall be provided to ensure ease of operation of all specified characteristics. Where applicable, clockwise rotation of controls shall result in an increasing function; controls, switches, visual signals and indicating devices, input and output connectors, terminals and test points shall be clearly marked or labeled on the hardware to permit quick identification of intended use and location.

4.6 Test Function

A. The system shall include a provision that permits testing from any alphanumeric keypad. The test shall include standby battery, alarm bell or siren, and communication to the central station.

B. The system shall include a provision for an automatic, hourly, daily, weekly, thirty (30) day, or up to sixty (60) day communication link test from the control panel installation site to the central station.

C. The system shall include a provision for displaying the internal system power and wiring conditions. Internal monitors shall include the bell circuit, AC power, battery voltage level, charging voltage, panel box tamper, phone trouble line 1, phone trouble line 2, transmit trouble, and network trouble.

4.7 Power Supplies

A. Power supplies for the control unit shall operate from 120 VAC, supplied at the respective protected areas. Standby batteries shall be supplied to power the system in the event of a utility power failure. Batteries shall be sized to provide 105% capacity for eight hours. Standby batteries shall be sealed lead-acid. Power supplies shall be all Solid State.

B. Controls shall be designed to maintain full battery charge when alternating current is available. Batteries shall be recharged to 85% capacity within 24 hours from battery use. The system shall be automatically transferred to battery power upon loss of alternating current power and return to alternating current power upon restoration. Intrusion alarms shall not be initiated during switch over; a signal shall be initiated upon failure of battery or alternating current power.

C. Approved power supplies shall meet or exceed the following power supply model specifications:

- UL Listed DMP 505-12: 12VDC 5 Amp with transformer and enclosure.

4.8 Software

A. The system shall interface with computer software with the capability to fully program the panel by connecting to the panel through:

- Direct cable connection interface card
- Receiver phone line connection
- Standard phone line connection
- Ethernet network connection
- Network connection across the Internet
- Cellular network connection using the 263C or 263H Cellular Communicators

B. The system shall interface with computer software capable of locking down all controlled doors.

C. The system shall interface with computer software capable of monitoring and logging all events.

D. The system shall interface with computer software capable of exporting reports in the following file formats:

Excel spreadsheet (*.xls	Text (*.txt)
Rich Text (*.rtf)	Comma-separated (*.csv)
Windows Metafile (*.wmf)	HTML document (*.htm)
QuickReport (*.qrp)	

E. The system shall interface with computer software capable of printing custom, filtered reports including:

All Events	Door Access Granted
Zone Action	Door Access Denied
Arming/Disarming	Opening/Closing Schedule Changes
Area Late to Close	System Monitors
User Code Changes	System Events

4.9 Graphic User Interface (GUI)

Entré – Access and Security Management Software

System Features:

A. The software shall be available in three package sizes.

Entré Lite™: Shall have 16 doors included, and a maximum of four XR150/XR350/XR550 Series panels, personnel management, full reports, and event management.

Entré Business™: Shall have the same features as Entré Lite with the option of expansion to 96 doors maximum and up to 24 XR150/XR350/XR550 Series panels.

Entré Enterprise™: Shall have the same features as Entré Business with 96 doors included with the ability to expand to an unlimited number of doors, users and XR150/XR350/XR550 Series panels.

B. Shall have simple user management, with the ability to import users from existing databases.

C. Shall be able to assign user access by group, facility or other parameters.

D. Shall have drop down lists for devices, user data and other information to facilitate fast and accurate searches.

E. Shall be able to view system status in one of a variety of views for simplified alarm monitoring management.

F. Shall have the capability to customize reports for added flexibility.

User Management:

A. It shall have the ability to import into Entré from existing systems via standard comma-separated value (CSV) format files. It shall easily add new users, capture and edit their photo for badging or visual verification from within the application.

B. User fields shall be fully customizable. Assign specific rights or events by user or by group. The software shall be able to create effective/expiration time for users, limiting access to only certain times of the day, and only certain days, or for only a defined period of time.

AES Encryption:

A. Entré Enterprise shall support the XR550 Series with Encryption panel AES (Advanced Encryption Standard) strong data security for sensitive personnel and facility data.

Highly Customizable:

A. The software shall be extensively customizable to create a system that matches the end user's application's needs.

B. Shall define what events are considered "alarms," and what response is required from the system operator.

C. Shall be able to tailor user data with up to 20 available user-defined fields.

Hierarchical Views:

A. The software shall have the ability to select from four different system views, with the ability to have multiple views open simultaneously. Select the graphical Map view, tabular Event view, or hierarchical Tree view.

B. The software shall be able to click on a device or alert to access additional information and process the event. In text-based views, software shall have simple drill downs to allow fast navigation to the desired item.

Powerful Search:

The software shall employ industry standard SQL database for quick and easy search to identify any desired device or user which is compatible with nearly any database.

Single-System Control:

The software shall employ a network solution to manage installations and users from any location. A single, unified database means there's one badge, one face or one fingerprint, worldwide.

Entré – Access & Security Management Software

Optional System Modules:

- ENTRE-4DR Additional 4-Doors
- ENTRE-16DR Additional 16-Doors
- ENTRE-32DR Additional 32-Doors
- ENTRE-64DR Additional 64-Doors
- ENTRE-STD Standard Client
- ENTRE-WEB Web Client
- ENTRE-MAPS Alarm Graphics
- ENTRE-AUTO Automation Module
- ENTRE-DVR DVR Module
- ENTRE-PART Database Partitioning
- ENTRE-LANG Multiple Language module
- ENTRE-LDAP Lightweight Directory Access Protocol
- ENTRE-IMAGE Personnel Image Capture
- ENTRE-BADGE Badge Designer
- ENTRE-SIGN Signature Capture

Optional System Modules Features:

A. Shall be able to Point-and-click control of alarms and devices.

B. Shall have a modular design to enable customization, with optional modules for added features.

C. Shall be available in French, Spanish, or English, with dual- language operation mode.

D. Shall have full reporting, including at-a-glance dashboard graphics and charts or traditional tabular displays, with the ability to produce reports in a variety of file types.

E. Shall have DVR integration.

F. Shall have image management of users and event photos.

G. Shall have a custom badge builder and video badging.

Door Modules:

The software shall allow for the addition of additional doors to support Entré Business or Enterprise systems.

Alarm Graphics:

A. The software shall allow for the addition of additional doors to support Entré Business or Enterprise systems.

B. Shall have the ability to give graphical representation of events and alarms at-a-glance and give feedback of system status.

C. Shall have the capability to upload an unlimited number of graphical images of protected facilities in a variety of file formats.

D. System maps are linked from level to level, allowing drill down from a macro view to a specific room or area.

E. View alarm status at every level of zoom.

F. User-defined layers representing different alarm types allow you to customize the graphical interface to meet application needs.

G. Once loaded, it shall have the ability to plot alarm devices on the graphics using drag-and-drop selections from a hierarchical list of hardware. Identify the areas on your site maps, defining them by Classification, Entrances, Zones, and Partitions.

H. It shall have total picture-based monitoring and control of the system. It shall from facility-wide views be able to click to zoom in on any area of the facility and view the real-time status of any device.

I. The software shall be able to click on the alarm display icon to acknowledge an alarm or to request additional information

Automation Module:

A. The software shall be able to give advanced users the power to create automated system actions.

B. The software shall be able to define automatic responses to any system alarm or events. These include generating a report, generating an alert email, or sending commands to selected devices.

C. Shall be able to create scheduled system actions to run once at a specified time and date, or scheduled events that repeat at user defined time and date intervals.

D. System automation enables configuration of unattended activities, freeing system managers from many routine responsibilities.

DVR:

A. The software shall be able to quickly connect to a DVR to review video based on a received alarm from a control panel.

B. Connect to DVR from a graphical map of the area to review activity.

- Verint

  NetDVR I, firmware 6.47.x or higher

  NetDVR II, firmware 8.7.x or higher

  EdgeVR, all firmware versions

- 3VR

  E-Series

  P-Series

  S-Series

  ServerClass

- March Networks™

  3204 Digital Video Recorder (3000 Series)

  4000 C NVR (4000 C Series)

- Dedicated Micros

  All NetVU compatible series 2 and 3 DVRs

Database Partitioning:

A. The software shall allow system information to be contained in a single unified database allowing system managers to limit user access to only certain areas of the database to partition the information.

B. The software shall allow organization of data into separate collections by physical area, hardware types, events, or other parameters.

Multi-Language:

A. The software shall support multiple languages enabling multiple operators to select a language during their login process. The software shall allow text shown both in English and a second selected language.

B. Available languages shall include:

- English
- French
- Spanish

LDAP (Lightweight Directory Access Protocol):

A. The software shall provide LDAP single sign-on for users, enabling them to use one password to access multiple system services.

B. System user information can be imported directly from an existing LDAP Tree.

Badge Image Capture:

The software shall allow the transfer of pictures of users from a digital camera directly onto a badge. Select a TWAIN source to capture the image to allow up to date images on employee badges.

Badge Designer:

A. The software shall have the ability to create one or more badge designs, customizing badges by facility, user level, or other parameters.

B. When badging employees or visitors, select the desired badge template from library. The template automatically populates with the appropriate data, ready for printing.

Signature Capture:

Shall use a signature capture device to provide the ability to capture employee or visitor signatures and store the images.

Reporting Dashboard:

A. The software shall have interactive graphics for instant feedback on system activity.

B. The software shall be able to choose a number of charts for functions such as Access Granted /Denied at a particular access point or an entire facility to get a snapshot of activities within any defined time period.

C. Shall have ability to filter through user, activity, or event data to narrow results and show precisely the information needed.

D. Shall have the ability to view reports from within the application, or saved and exported to PDF, HTML, XLS, CSV, or XML format for distribution.

E. Shall automate custom reports to generate and distribute each day at desired times.

4.10 Control Panel Capability

A. The basic control panel shall provide:

- Expansion to a total of at least 10,000 user codes with 99 user profile definitions.
- Temporary user codes that can be entered with a finite date and specific time to expire.
- Sixteen (16) independent door/keypad addresses, each with four zones on XR550 and XR350, with eight (8) on the XR150.
- A total door access granted event buffer of at least 10,000 events.
- Anti-passback access control selectable by area and user.
- A total of at least 99 programmable Schedules for output relay schedules, area schedules, door schedules, holiday schedules, and user profiles. The same schedule may be assigned to more than one area, door, or output, making them reusable. There shall be at least two schedules per user profile with up to four profiles per user. Up to 8 Schedules per user, per door, per area, and per output.
- Eight Areas (8) individual reporting areas XR150, Sixteen (16) individual reporting areas XR350, and Thirty-two (32) individual reporting areas XR550.
- Built-in bell and telephone line supervision.

B. The networked control panel shall provide the entire above plus:

- All of the above features plus.
- Require two-man access code or credentials. Require two user code entries to disarm and/or allow door access to this area.
- Support programming to require the same or different access code entered within a programmed delay time of 1 to 15 minutes after disarming before activating a silent ambush alarm.

- Early Morning Ambush. Must disarm a second time with in a programmed period of time or an early morning ambush silent alarm is sent.
- Bank Safe & Vault features. Schedules set for this area and the time of day cannot be changed while the area is armed.

C. The XR550 encrypted control panel shall provide the entire above plus:

- All of the basic and network features listed plus.
- Built-in Encrypted Alarm Router.
- Certified operation that meets NIST (National Institute of Standards and Technology) standards for 128-bit and 256-bit AES (Advanced Encryption Standard) Encryption.
- Certification that encrypted panel is capable of meeting ICD 705 Chapter 7 Intrusion Detection Systems (IDS) Standard.
- Certification that encrypted panel is capable of meeting UL 2050 standards.
- Card plus Pin for High security card access is provided by the Card Plus Pin feature that requires both a card read and a PIN (4-6 digit user ID) entry for arming/disarming and access by area. This Card Plus Pin operation complies with the ICD 705 requirement for dual id authentication and operates with a DMP Prox Keypad and a HID ProxPro reader with the keypad connected to a DMP Wiegand Interface module.
- Panic Test allows the panic zone test verification and failure results to be sent to the central station receiver.
- Passphrase of 8-16 characters to validate encryption between the XR550 with Encryption and the Central Station Receiver.

5.0 FUNCTIONAL DESCRIPTIONS

5.1 System Description

A. The system areas and zones shall be programmable, and the system shall store, log, display, and transmit specific custom designations for system areas, zones, and user names.

B. To ensure continued, one-call support, the system shall be constructed of sensing components provided directly by the system manufacturer, such as power supplies, motion detectors, door and window position switches, glass break detectors, or other sensing devices that the manufacturer offers.

C. The system controller, user interfaces, zone input devices, relay output devices, and the system signal receiving equipment shall be engineered, manufactured, assembled, and must be distributed from a location within the United States of America.

D. The system shall support user interaction by way of a keypad, web browser, system software, key switch, or radio frequency wireless control, Text messaging, or Smart Phone Application using integrated or auxiliary devices provided by the system manufacturer.

E. The system shall support controller zone input connections, system keypads, system zone expansion modules, and wireless zone input modules, and must support zone input connections by way of at least two competitive products. The system shall offer a seamless integrated compatibility with hard-wire and/or wireless zone expansion equipment for at least 500 wireless zones and/or a maximum of 574 hardwired zones.

F. The system shall be capable of offering up to five zone expansion buses, each of which can support the connection of up to 15,000 feet of four-wire cable. Zone expansion and keypad data buses that exceed 2,500 feet of cable must include splitter/repeater modules to boost data voltage and maintain data integrity.

G. The system shall provide a seamless capability to provide up to 506 addressable relays, which can be located at any connection location upon a zone expansion bus.

H. System relay outputs shall have the capability of being triggered as a result of a command from the user interface, changes in system status, changes in zone status, or by a programmable schedule.

I. System relay output states shall be programmable for momentary, maintained, pulsed, or must follow the state of an associated system zone input.

J. The system shall be completely programmable either locally from a keypad or remotely through a standard dial-up, and network connections by way of a LAN, WAN, and/or by way of the Internet, cellular communications paths.

K. The control unit shall be completely programmable remotely using remote annunciators, and/or using upload/download software that communicates using SDLC 300 baud, 2400 baud, or IP Addressed data network. On-site programming from a personal computer shall also be permitted.

L. The control unit shall be equipped with an anti-reversing circuit breaker to prevent damage due to accidental reversal of battery leads.

5.2 Input/output Capacity

A. This system shall be capable of monitoring a maximum of 574 individual zones and controlling a maximum of 506 output relays.

B. The control panel shall have, as an integral part of the assembly, 2 SPDT Form C relays rated at 1 Amp at 30 VDC and four open collector 12 VDC outputs rated at 50mA each. It shall also have the capacity of a maximum of 125 output expander modules with 500 switched ground, open collector outputs, 50mA maximum and 506 auxiliary relays (Form C rated at 1.0 Amp at 30 VDC).

C. The panel shall also provide 99 programmable output profiles for schedules, and include an integral bell alarm circuit providing at least 1.5 Amps of steady, pulsed, or temporal bell output. Output type shall be programmable by zone type. Relays and voltage outputs shall be capable of being independently programmed to turn on and/or off at selected times each day.

D. The system shall be capable of supporting and controlling up to 232 Z-Wave devices and up to 20 Z-Wave Favorites for group control.

5.3 User/Authorization Level Capacity

The system shall be capable of operation by 10,000 unique Personal Identification Number (PIN) codes with each code having one (1) of ninety-nine (99) custom user profiles. This allows for limitation of certain functions to authorized users. The operation of all keypads shall be limited to authorized users.

5.4 Keypads

A. The system shall support a maximum of sixteen (16) keypads on XR550/XR350 Series or eight (8) keypads on XR150 Series with alphanumeric display. Each keypad shall be capable of arming and disarming any system area based on a pass code or Proximity key authorization. The keypad alphanumeric display shall provide complete prompt messages during all stages of operation and system programming and display all relevant operating and test data.

B. Communication between the control panel and all keypads and zone expanders shall be multiplexed over a non-shielded multi-conductor cable, as recommended by the manufacturer. This cable shall also provide the power to all keypads, zone expanders, output expanders, and other power consuming detection devices.

C. If at any time a keypad does not detect polling; the alphanumeric display shall indicate “SYSTEM TROUBLE”. If at any time two devices are programmed for the same address, the alphanumeric keypad shall display “4 WIRE BUS TROUBLE”. If at any time a keypad detects polling but not for its particular address, the alphanumeric display shall indicate “NON POLLED ADDR”. The system shall display all system troubles at selected keypads with distinct alphanumeric messages.

D. The keypad shall include self-test diagnostics enabling the installer to test all keypad functions: display test, key test, zone test, LED test, relay test, tone test, and address test.

E. The keypad shall provide an easy-to-read English text display. The text shall exactly match the text seen in all software reports, keypad displays, and central station reports.

F. The keypad user interface shall be a simple-to-use, menu-driven help system that is completely user friendly.

G. The control panel shall support a keypad interface accessible on the World Wide Web in a browser window. The web-accessible keypad interface shall provide at least five (5) programmable hyperlinks for camera access or other use.

5.5 Zone Configuration

A. A minimum of 4 Class B ungrounded zones shall be available at each keypad or zone expander on the system. The system shall have the capacity for a maximum of sixteen (16) keypads and a maximum of 125 four (4) zone expanders or 500 single zone expanders on the XR550. It shall also have the capacity of a maximum of 125 supervised relay output expanders. The XR350 shall have the capacity for a maximum of sixteen (16) keypads and a maximum of 125 four (4) zone expanders. It shall also have the capacity of a maximum of 75 supervised relay output expanders. The XR150 shall have the capacity for a maximum of eight (8) keypads and a maximum of 25 four (4) zone expanders It shall also have the capacity of

a maximum of 25 supervised relay output expanders. All Class B zones shall be 2-wire, 22 AWG minimum, supervised by an end-of-line (EOL) device and shall be able to detect open and short conditions in excess of 500ms duration.

B. Each zone shall function in any of the following configurations: Night, Day, Exit, Fire, Supervisory, Emergency, Panic, Auxiliary 1, Auxiliary 2, Fire Verification, Cross Zone, Priority, and Key Switch Arming.

C. The digital SLCs and the annunciator/keypad bus shall be able to operate at a maximum wiring distance of 2500 feet from the control panel on unshielded, non-twisted cable. This distance may be extended to a total of 15,000 feet when bus repeater modules are installed.

D. Each zone shall function in any of the following configurations:

Night	Supervisory	Auxiliary 1	Cross-Zone
Day	Emergency	Auxiliary 2	Priority
Exit	Panic	Fire Verification	Arming
Fire			

5.6 Communication

A. The system shall be capable of signaling to as many as 8 remote monitoring station receivers. Seven (7) of the eight (8) paths shall be capable of being assigned as either a “primary” or “backup” path. In such a manner the system shall have multiple primary paths to multiple remote monitoring stations as well as multiple backup paths to multiple monitoring stations.

B. The system shall employ Adaptive Technology that allows a Backup communication path programmed for Network or Cellular to automatically ADAPT to the faster check-in rate of the Primary path should the Primary path become unavailable. This creates a seamless transition for communication.

C. The system shall be capable of dialing up to (2) remote monitoring station receivers, four telephone numbers of 32 digits each using two separate switched telephone network lines such that if two unsuccessful attempts are made on the first line to the first number, the system shall make two attempts on first line to the second number. If these two attempts are unsuccessful, the system shall make two further attempts on the first line of the first number. After the tenth unsuccessful attempt, dialing shall stop and the alphanumeric keypad shall display trouble. Should another event occur that requires a report to be transmitted, the dialing sequence shall be repeated. The system shall have a programmable option to dial a second set of telephone numbers after the first ten attempts using the same sequence.

D. The system shall be capable of communication using the IBM Synchronous Data Link Control format, and at least one other standard industry format.

E. The system shall be capable of supporting Network communication with digital dialer backup, existing Ethernet data networks, satellite communication, fiber optic networks, local area networks, wide area networks, cellular communication, and retail data networks.

5.7 Network Communication

A. The control panel shall be capable of asynchronous network communication with a retry time between 2 and 240 minutes and a fail time of 2 and 240 minutes. If communication is unsuccessful the control panel shall be capable of attempting backup communication through any of the available communication methods to the same receiver or a backup receiver.

B. The control panel shall employee adaptive communication technology. Adaptive Technology allows a Backup communication path programmed to use Network or Cellular to automatically ADAPT to the faster check-in rate of the Primary path should the Primary path become unavailable, creating a seamless transition for communication of messages. Select Adapt when programming the Checkin option. This allows a system to be fully supervised even if a path fails, while also keeping wireless charges low when the network is good.

C. Network communication between the control panel and the receiver shall be in a proprietary communication format.

D. The control panel shall be capable of supporting Dynamic Host Communication Protocol (DHCP) Internet Protocol (IP) addressing.

E. Underwriters Laboratories (UL) shall list network communication by the control panel for Standard or Encrypted Line Security.

F. The control panel shall be capable of two-way network communication using standard Ethernet 10/100 BaseT in a LAN, WAN, or Internet configuration.

G. The control panel shall be capable of communication by means of a 128-bit or 256-bit AES (Advanced Encryption Standard) Encryption process certified by NIST (National Institute of Standards and Technology) to an SCS-1R receiver with an SCS-104 line card or SCS-VR (SCS-VR currently supports 128-bit encryption only).

H. The control panel shall be capable of meeting ICD 705 Chapter 7 Intrusion Detection Systems (IDS) and UL 2050 standards.

I. The control panel shall be capable of sending text messaging to up to three Cellular Phone Numbers using cellular communications.

J. The control panel shall be capable of sending the following SMS messages:

Zone Alarms by Zone Name	AC Power Trouble and Restoral
Zone Troubles by Zone Name	System Low Battery
Zone Bypass by User	Ambush
Arming (Closings) by User	Abort, Cancel and Alarm Verified by User
Disarming (Openings) by User	Check-in by user
Late to Close	

5.8 Cellular Communications

A. The control panel shall have the capability to communicate with a plug-in cellular HSPA+ communicator model number 263H or CDMA communicator model number 263C that shall plug into the control panel J24 connector which shall supply full data communication and power to the 263H or 263C cellular communicator. The cellular communicator shall be capable of communicating full panel alarm and auxiliary messages to the DMP SCS-1R Central Station or SCS-VR Receiver as well as SMS text messaging to a PC, PDA, or Cellular telephone.

B. The control panel shall be capable of sending the following SMS messages

Zone Alarms by Zone Name	AC Power Trouble and Restoral
Zone Troubles by Zone Name	System Low Battery
Zone Bypass by User	Ambush
Arming (Closings) by User	Abort, Cancel and Alarm Verified by User
Disarming (Openings) by User	Check-in by user
Late to Close	

5.9 TCP/IP Network Trapping

A. The control panel shall be capable of having communication set to Network operation. When a trap is set in Remote Link, the software shall be capable of sending a panel trap message with the panel account number to the SCS-104 installed in an SCS-1R receiver.

B. The receiver SCS-104 shall store the trap and monitor the panel for the next message. When the panel sends its next message, the receiver SCS-104 shall then send a message to the panel to contact Remote Link at the IP address contained in the original trap message.

C. The trap message shall be stored in the receiver SCS-104 for up to four hours. If the trap message is not sent to the panel within the four-hour window, the panel trap message shall be discarded and a new trap message must be sent from Remote Link.

D. The user shall be able to view the trap status in the receiver SCS-104 in Remote Link using the Trap Query function.

6.0 INTEGRATED INTRUSION ALARM AND ACCESS CONTROL OPERATION

6.1 Access Authority Levels

The system shall be capable of programming access credentials authority levels to check whether the user has access to a specific area and also has the authority to disarm or arm the area. If the user access credential has access and disarm/arm authority the system shall provide the user the option to disarm the area simultaneously upon opening the door, or to open the door and begin an entry delay timer. With the timer option the user then disarms the area using an intrusion control keypad inside the area. If the user only has access authority to the area and the area is in an armed condition, the user is denied access to the area.

6.2 Door Open Schedule Override

The system shall be capable of programming certain area doors to be scheduled to unlock and lock at specific times of the day or night. The lock/unlock function shall be capable of an override option depending upon the area armed/disarmed status. If the area remains in an armed status at the scheduled unlock time the armed status overrides the unlock schedule ensuring the doors remain locked and armed in situations where the business might open late, close early, is affected by inclement weather, or another emergency.

6.3 Common Area

The system shall be capable of programming a common area to be armed when the last area in the system is armed and disarmed when the first area in the system is disarmed. To ensure the common area works properly it shall not have any user codes assigned to the common area. The system shall also be capable of programming multiple common areas.

6.4 Area Access Control

A. The system shall be capable of integrating area access control capability where specified into the same control panel with the ability to have up to 10,000 user credentials. User access is limited to custom profiles and/or schedules. Anti-passback shall be available. The networked version shall support a Two-Man Rule feature. The system shall support up to sixteen (16) access doors, connected to the system using a manufacturer-approved interface module.

B. Area door access products shall meet or exceed features offered by the following products:

- Keypad reader/administration device – DMP Model 7063/7063A, 7073/7073A, 7163/7173, 7872, 7873
- Wiegand Interface – DMP Model 734, 734N, or 734N-WIFI
- Reader – DMP Model PP-6005B, Model PR-5455, Model MP-5365
- Cards or credentials – DMP Model 1326, DMP Model 1306P, DMP Model 1346, DMP Model 1386

6.5 Access Control Equipment

Access Control equipment shall communicate to the system by way of the control panel keypad bus. The equipment shall have a three (3) year warranty and meet or exceed features offered in the products listed in Section 11.5 of this document.

6.6 Early Morning Ambush (XR550 only)

A. The system shall be capable of programming an area to require two user codes be entered within a programmed number of minutes to prevent an ambush message from being sent to the Central Station Receiver. If both user codes are not entered within the time an ambush message is sent to the central station receiver.

B. Both user codes shall have the authority to disarm the specific area and must be entered at the same keypad or reader. The keypad shall not display any indication that the ambush timer is running.

C. The system shall be capable of programming an output to provide an external indicator that an ambush situation is taking place.

6.7 Two-Man Rule (XR550 only)

The system shall be capable of programming an area to require two separate user codes be entered in order to disarm and/or allow access to a specific area. Both required codes shall have at least the same or greater authority level. Both required codes shall be entered within 30 seconds or an alarm shall activate.

6.8 Panic Button Summary Test

A. The system shall have the ability to test panic buttons without sending a panic alarm to the Central Station Receiver.

B. The system shall also have the ability to send panic zone test verification and failure results to the Central Station Receiver.

C. During the test, each time a panic zone trips, the display number shall increment and the keypad buzzer sound for two seconds.

D. The number of panic zones tripped shall constantly display until the test ends or no panic zone activity has occurred for 20 minutes.

E. When the Panic Zone Test ends and a zone failed (did not trip) during the test, the keypad shall be able to display the zone name and number and have the buzzer sounds for one second. Additional zone failed zones shall display when a button is pressed.

6.9 One-man Walk Test

A special code is also available for installers to test the system. The One-Man Walk Test feature allows a single technician to check the panel response to burglary, fire, panic, and supervisory zones.

6.10 Multi-lingual Display Option

The system shall be programmed to display the User Menu and Status Display text in multiple languages.

6.11 User Inactivity Audit

System shall allow user code inactivity to notify the central station after a programmable period of days of no activity. The system shall be programmable from 0-365 days.

6.12 Lock Down

The system shall for emergency situations, a lock down command can be issued from the keypad menu or via remote command and locks all doors designated as public.

6.13 Communication Function Diagnostics

The system shall have enhanced diagnostic menu that enables technicians to check network and cellular communication status and cell signal strength from the keypad.

6.14 GUEST Operation

The system shall be capable of in the Home/Sleep/Away with Guest House operation, create up to three separate systems (main and two guests). Keypads in each system can selectively arm the perimeter, interior, or bedrooms for only their protected areas. Main system users can add authorized users to all protected areas, but guests can add users only for their protected system.

7.0 FALSE ALARM REDUCTION FEATURES

The system shall be capable of providing false alarm reduction features, functions, capabilities, or processes that either require alarms be verified or potential alarms be corrected before a system or zone can be placed into an armed state.

7.1 Exit Error Alert and Reporting

The panel shall be able to provide an automatic function to prevent a false alarm from occurring if an exit door does not properly close after the system is armed.

7.2 Entry and Exit Delay Annunciation

A. When arming, the system shall provide clear annunciation indicators to the user about the need to exit the premises prior to the exit delay time expiring.

B. When disarming, the system shall notify the user the need to disarm the system prior to the entry delay time expiring.

7.3 Remote Annunciation

The system shall be able to provide entry and exit delay time period notification. This notification can be from DMP keypads, remote annunciators, or bell tests.

7.4 Abort Reporting

The system shall be capable of sending an Abort report to the central station if the system is disarmed while the alarm is still sounding. The Abort report shall be sent after the alarm report to notify the central station that an authorized user has cancelled the alarm.

7.5 System Testing

The system shall offer testing features that are simple, quick, and complete and provide the highest measure of safety by ensuring that alarm conditions are detected and communicated to the proper authorities in a timely manner and on a regularly scheduled basis.

7.6 Ambush Code

The system shall offer ambush codes for those dangerous encounters where the user is instructed to either arm or disarm the system under threat of harm. The duress code shall disarm the system without giving local indication of an alarm that might put the user well-being in jeopardy.

7.7 Two-Button Panic Feature

The system shall support DMP keypads that provide the option to use only two-button panic codes. The user shall be required to press and hold two designated keys for approximately two seconds before the system generates a panic alarm.

7.8 Fire Verify Zones

The system shall support Fire Verify zones to help the panel verify the existence of an actual fire condition before it sends an alarm report to the central station. The Fire Verify zone shall require the panel to perform a Sensor Reset whenever a device connected to a Fire Verify zone initiates an alarm. This shall begin a verification period during which the panel waits for a second alarm initiation. If the original zone or any other Fire Verify zone on the panel initiates an alarm within the next 120 seconds, the panel shall recognize this as an actual alarm and send an alarm report to the central station.

7.9 Cross-Zoning Protection

The system shall support cross-zoning as a means of requiring two device trips to occur within a short period of time before sounding an alarm and sending an alarm report to the central station. Supported device trips shall be from one device that trips two times, or from two devices that each trip once.

7.10 Swinger Zone Bypassing

The system shall be capable of automatically bypassing a zone if it goes into an alarm or trouble condition a specified number of times within a one-hour period. The panel shall be able to track the number of times the zone trips while armed and compare that against a programmed number. When that number is reached, the panel shall be able to automatically bypass the zone. The panel shall be capable of resetting the zone when the area to which it is assigned disarms, is manually reset from the keypad or remotely, or remains normal for one hour.

7.11 Recently Armed Report

The system shall be capable sending a System Recently Armed report, along with a zone alarm report, to the central station any time an alarm occurs within five minutes of the system arming. The System Recently Armed report allows the central station operator to follow a “call the subscriber first” procedure instead of immediately dispatching the police to what could be a false alarm.

7.12 Transmit Delay

The system shall be capable of programming the panel to wait up to 60 seconds before sending burglary alarm reports to the central station. If an alarm is accidental, the user shall be able to disarm the system within the programmed Transmit Delay time. An Abort report shall be sent in place of an alarm report after the system disarms. During the alarm, sirens and panel relay outputs shall not be delayed and shall still provide local condition annunciation.

7.13 Call Waiting Cancel

The system shall be capable of being programmed to cancel call waiting any time the panel dials the receiver number to send a report.

7.14 Cancel/Verify

The system shall be capable of sending either a Cancel Report or Verify Report to the Central Station to signify that the end user has Canceled an Alarm or Verified an Alarm condition. Also the system shall be programmable to instead of

Cancel/Verify show “IS THIS A FALSE ALARM? NO YES”. If YES send validation of alarm to Central Station, if NO send alarm cancel.

8.0 Must meet ANSI/SIA CP-01-2010 Standards for False Alarm Reduction

The system shall be capable of meeting ANSI/SIA CP-01-2010 Standards for False Alarm Reduction.

8.1 Shall Meet Exit Delay Standards

- Default – 60 seconds (Minimum 45 seconds)
- Progress Annunciation – different sound last ten seconds of delay
- Automatic Restart of running exit delay, one time upon re-entry
- Recent Closing – signal sent if alarm within 2 minutes of Exit time expiration (change from 5 min)
- Exit Error – Immediate local alarm and entry delay starts

8.2 Shall Meet Entry Delay Standards

- Default – 30 seconds (Minimum 30 seconds)
- Pre-Warning Silenced – after first digit code entry
- Cancel Message sent if disarmed after alarm sent

8.3 Shall Meet Fail-to-Exit Standards

When perimeter and exterior areas are defined and the user does not leave the building before the system arms, the system only arms the perimeter and leaves the interior unarmed

8.4 Shall Meet Automatic Restart Standards

The system shall stop the Exit countdown once and restart it to allow the user to pick up a forgotten jacket or briefcase and exit the building without sending an alarm to the central station.

9.0 NOT USED

10.0 BURGLARY CONTROL SPECIFICATIONS

10.1 Burglary Standards

The Burglary system shall be listed as a Power Limited Device and be listed under the standards below. Each system shall be supplied with complete details on all installation criteria necessary to meet all of the listings.

Burglary Listings	**Canadian Burglary Listings**
UL 1023 Household Burglar Alarm System Units	ULC C1023 Household Burglar Alarm System Units
UL 1076 Proprietary Burglar	ULC/ORD-C1076 Proprietary Burglar
UL 1610 Central Station Burglar Alarm Units	ULC S304 Central Station Burglar Alarm Units
UL 1635 Digital Burglar Alarm Communicator System Units	
U.S. Government Standards	
Meets ICD 705 Chapter 7 Intrusion Detection Systems (IDS)	
Meets DoD/NIST SCIF Standards	
Meets ANSI/SIA CP-01-2010 False Alarm Reduction	

10.2 Area System Mode

A. The system user shall be capable of selectively arming and disarming any one or more of 32 areas within the intrusion detection system based on the user PIN code and/or keypad used. Each of the 574 zones shall be able to be assigned to any of the 32 available areas. The system shall be capable of having up to a thirty-two (32) character length name programmed for each area.

B. The system user shall be capable of assigning an opening and closing schedule to all areas or to each of the 32 areas separately. Each area shall be able to arm or disarm automatically by a schedule. The system shall have the capacity for common areas that automatically disarm when any other area disarms and that automatically arm when all others areas arm.

C. The networked system shall have the ability to comply with Bank Safe & Vault application. The networked system shall also have the ability to use a two-man rule for disarming or allowing door access to an area. The system shall have the ability to operate a Common Area application.

D. The Encrypted system shall have the feature of Card Plus Pin by area High security card access is provided by the Card Plus Pin feature that requires both a card read and a PIN (4-6 digit user ID) entry for arming/disarming and access by area. This Card Plus Pin operation complies with the ICPG 705 requirement for dual id authentication and operates with a DMP Prox Keypad and a HID ProxPro reader with the keypad connected to a DMP Wiegand Interface module.

10.3 Home/Sleep/Away Mode

The system shall be capable of being configured in a Home/Sleep/Away configuration for Residential applications. The system shall consist of a Main House system and up to two Guest House systems within one single control Panel with each house being controlled with its own keypad as if it were separate alarm systems.

10.4 All/Perimeter Mode

The system shall be capable of being configured into the All/Perimeter configuration to enable the selective arming of both the interior and perimeter when armed “All” or arming just the perimeter devices if arming “Perimeter”.

10.5 Zones

The system shall have a minimum of eight (8) grounded burglary zones available from the control panel, and two floating ground powered zones for two wire type compatible smoke detectors. The system shall have the ability to expand using the panel’s keypad bus for up to sixty-four additional zones. The system shall also have five built-in zone expansion bus (LX500 – LX900) for an additional 500 zones of expansion. The system shall have the ability to integrate up to 500 wireless zones for a total of 574 zones overall.

10.6 Burglary Equipment

Burglary detection equipment shall communicate to the system by way of the control panel loop expansion bus or 900MHz bi-directional spread spectrum receiver. The detection equipment shall have a three (3) year warranty and meet or exceed features offered in the products listed in Section 11.0 of this document.

10.7 Z-Wave Equipment

The system shall be capable of 232 Z-Wave devices by means of the use of the model 738Z module. The system shall have the capability of up to 20 Z-Wave favorites for grouping Z-Wave devices into a favorite response or control.

11.0 ACCESS CONTROL SPECIFICATIONS

11.1 Access Control Standards

The access control system shall be listed as a Power Limited Device and be listed under the standards below. Each system shall be supplied with complete details on all installation criteria necessary to meet all of the listings.

Access Control Listings	U.S. Government Standards
UL 294 Access Control System Units	Meets ICD/ICS 705 Chapter 7 Intrusion Detection Systems (IDS)
	Meets DoD/NIST SCIF Standards

11.2 Keypad

A. The system shall display a message at any keypad when any system area remains disarmed past the scheduled closing time. The message shall be displayed at one minute past the scheduled closing time. A pre-warn tone shall also begin sounding. If

the system is not armed or a schedule extended within ten minutes past the scheduled closing time, the system shall provide the option of sending a Late to Close report to the central station.

B. The keypad shall include a door strike relay capable of sending a report to the central station when activated.

C. The keypad shall be capable of proximity arming and disarming functions.

D. The keypad shall display red backlighting when in alarm condition notifying an individual of an unacknowledged alarm condition.

E. The keypad shall annunciate when canceling an alarm condition the words “Cancel” or “Verify” to allow the end user the ability to cancel a user generated alarm or to select verify to send a message to the central station that the alarm has been verified by the end user and to send emergency response personnel. This is to comply with Alarm Verification.

11.3 Area Access Control

A. The system shall be capable of integrating area access control capability where specified into the same control panel with the ability to have up to 10,000 user credentials. User access is limited to custom profiles and/or schedules. Anti-passback shall be available. The networked version shall support a Two-Man Rule feature. The system shall support up to sixteen (16) access doors, connected to the system using a manufacturer-approved interface module.

B. Area door access products shall meet or exceed features offered by the following products:

- Keypad reader/administration device – DMP Model 7063/7063A, 7073/7073A, 7163/7173, 7872, 7873
- Wiegand Interface – DMP Model 734, 734N, or 734N-WIFI
- Reader – DMP Model PP-6005B, Model PR-5455, Model MP-5365
- Cards or credentials – DMP Model 1326, DMP Model 1306P, DMP Model 1346, DMP Model 1386

11.4 Access Control Equipment

Access Control equipment shall communicate to the system by way of the control panel keypad bus. The equipment shall have a three (3) year warranty and meet or exceed features offered in the products listed in Section 11 of this document.

12.0 COMPILED DETECTION EQUIPMENT LISTING

12.1 Hard-wired

Hard-wired detection equipment shall communicate to the system by way of the control panel loop expansion bus. The equipment shall have a three (3) year warranty as stated in the current DMP Product Catalog and meet or exceed features offered in the following products:

- Network Transient Suppressor – DMP Model 270
- Trouble Sounder – DMP Model 277
- Bus Splitter/Repeater Module – DMP Model 710
- Door Contact – DMP Model SM-20WG (surface applications – requires DMP zone expander)
- Output Expansion Module - DMP Model 716
- Graphic Annunciator Module - DMP Model 717
- Dual Phone Line Module – DMP Model 893A

Other product types shall connect directly to zone expansion modules such as:

- Addressable - DMP Models 521LX, 521LXT, 850S/711, 850D/711
- Non-Addressable - DMP Models 521B, 521-BXT, 850S, 850D
- Addressable - DMP Model 711
- Addressable - DMP Models 714, 714-8, 714-16
- Addressable - DMP Models 712-8
- Addressable - DMP Models 715, 715-8, 715-16

- Manual Fire Alarms – DMP Models 850S, 850D

12.2 Wireless

Wireless detection equipment shall communicate to the system by way of a compatible 900MHz receiver utilizing two-way communications, capable of receiving up to 500 wireless zones. The wireless system shall be programmed directly from the control panel, and shall not require a separate device programmer. The wireless detection equipment shall have a one (1) year warranty. It shall be capable of sending transmitter and battery status to the control panel's compatible receiver up to once every 60 seconds and must meet or exceed the following products:

- Wireless Receiver – DMP Model 1100X-W or 1100XH-W
- Wireless Repeater – DMP Model 1100R
- Universal transmitter – DMP Model 1101-W, 1102-W
- Universal Transmitter – DMP Model 1103-W
- Universal Transmitter – DMP Model 1105-W
- Wireless Window Transmitter – DMP Model 1107-W
- Wireless Zone Expander – DMP Model 1114-W
- Wireless Relay Output – DMP Model 1116-W
- Wireless LED Annunciator – DMP Model 1117R-B or 1117R-W
- Wireless Remote Indicator Light – DMP Model 1118R-B or 1118R-W
- Wireless Door Sounder – DMP Model 1119-W
- Motion Detector – DMP Model 1121-W, 1125-W, 1126R-W, 1126C-W, 1127W-W, and 1127C-W
- Glass Break Detector – DMP Model 1129-W
- Recessed Contact – DMP Model 1131-W
- Bill Trap – DMP Model 1139-I
- Panic Transmitter – DMP Model 1142-B, 1142-W, 1142BC-B, 1142BC-W
- Pendant Panic Transmitter – DMP Model 1145-1-B, 1145-2-B, and 1145-4-B
- Smoke Detector Transmitter – DMP Model 1161-W, 1162-W
- Wireless Smoke Detector – DMP Model 1165-W, 1165H-W, 1165HS-W
- Wireless Post Indicator Valve (PIV) – DMP Model 1181-R
- Wireless Outside Screw and Yoke Valve (OS & Y) – DMP Model 1182-R
- Wireless Heat Detectors 1183-135F and 1183-135R
- Wireless Carbon Monoxide Detector 1184-W

12.3 Power Supplies and Transformers

Power supply and transformer shall maintain system operation. The batteries shall be checked and replaced every three to five years. The equipment shall have a three (3) year warranty as stated in the current DMP Product Catalog and meet or exceed features offered in the following products:

- Power Supply – DMP Model 505-12, 115 VAC, 12 VDC
- Power Supply – DMP Model 505-12LX, 115 VAC, 12 VDC
- Power Supply – DMP Model 505-12L, 12 VDC
- Transformer - DMP Model 327, 16.5 VAC 50 VA, Plug-in

- Transformer - DMP Model 322, 16.5 VAC 56 VA, Wire-in
- Transformer - DMP Model 323, 16.5 VAC 56 VA, Wire-in
- Transformer – DMP Model 324, 16.5 VAC 100 VA, Wire-in
- Transformer – DMP Model 324P, 16.5 VAC 100 VA, Wire-in

12.4 Access Control Equipment

- Access control equipment shall provide access control functions between the panel and controller door access points. The equipment shall have a three (3) year warranty as stated in the current DMP Product Catalog and meet or exceed features offered in the following products:
- □ Interface Module – DMP Model 734, 734N, or 734N-WIFI Wiegand Interface Module
- □ Egress Module – DMP Model PB-2 REX Button
-
- □ Reader – DMP Model PP-6005B Proxpoint Plus©
- □ Reader – DMP Model MP-5365 Miniprox©
- □ Reader – DMP Model MX-5375 Maxi-Prox™
- □ Reader – DMP Model TL-5395 Thinline II™
- □ Door Controller – DMP Model 1306P Prox Patch™
- □ Door Controller – DMP Model 1306PW Prox Patch™
- □ Access Card – DMP Model 1351 ProxPass© Card
- □ Access Card – DMP Model 1326 Proxcard II© Card
- □ Access Device – DMP Model 1346 Proxkey II™ Keyfob, 1386 Isoprox II©
- 12.5 Cellular Communications Equipment
- Cellular Communications equipment shall plug directly into the XR150/XR350/XR550 PCB J24 connector and shall be supervised by the XR150/XR350/XR550 control panel. The Cellular Communications Equipment shall be of a low current draw and powered directly by the XR150/XR350/XR550 Control Communicator.
- The Cellular Communicator shall communicate in the SDLC Serial 3 Format for communications directly to a SCS-1R or SCS-VR DMP Central Station Receiver. The equipment shall have a three (3) year warranty as stated in the current DMP Product Catalog and meet or exceed features offered in the following products:
- □ 263H Digital HSPA+ Digital Cellular Communicator
- □ 263C CDMA Digital Cellular Communicator
- □ 380-400 Level 400 SIM Card (263H only)
- □ 381-2 18” Coax Cable
- □ 381-12 12’ Coax Extension
- □ 381-25 25’ Coax Extension
- □ 383 Rubber Duck Antenna
- □ 386 Wall Mount Antenna Bracket
- □ 387-1 3DB Fiberglass Antenna w/Bracket
- □ 387-3 3DB MEG Antenna
- □ 387-4 SMA to N Cable, 4ft
- □ 387-25 SMA to N Cable, 25ft

- 387-50 SMA to N Cable, 50ft
-
- 12.6 Z-Wave Wireless Devices
- The system shall be capable of 232 Z-Wave devices by means of the use of the model 738Z module. The following are compatible Z-Wave devices.
- 738Z Z-Wave Module
- Z-TZEMT400BB3X Z-Wave Thermostat
- Z-45602 Z-Wave Light Control Module with Dimmer
- Z-45603 Z-Wave Light Control and Appliance Module
- Z-99100-004 Z-Wave Door Deadbolt, Polished Brass
- Z-99100-005 Z-Wave Door Deadbolt, Satin Nickel
- Z-99100-006 Z-Wave Door Deadbolt, Venetian Bronze

13.0 INSTALLATION

13.1 System Component Installation

Materials shall be installed in strict compliance with all local, state, county, province, district, federal and other applicable building, safety, and fire standards, laws, codes, regulations, and guidelines including, but not limited to, all appendices and amendments and the requirements of the local authority having jurisdiction (AHJ).

14.0 EQUIPMENT:

Provide the following equipment.

XR550N DMP SECURITY PANEL

- 32 individual reporting areas, with common areas
- Up to 16 supervised door access-points and/or keypads
- Fully supervised 10/100 network and 3G/4G cellular communication
- Communications Diagnostics check network and cellular communication status from the keypad.
- 128 Bit AES (Advanced Encryption Standard) Encryption
- Flexible system arming features, with Instant Arming option
- Card plus pin and temporary codes
- Lock Down operation from keypad or remotely
- 10,000 user codes with 99 profiles
- 506 Outputs
- 12,000 event buffer
- 1.5 Amps 12 VDC smoke and auxiliary output with OVC protection
- Two Man Rule, Panic Button Test and Early Morning Ambush

7073 DMP KEYPAD / PROXIMITY READER

- Codeless arming and disarming
- On-board DMP proximity reader that allows users to simply present their proximity credentials to the keypad to gain access to a protected area.

- Momentary bypass to provide an entry and exit window on systems with 24-hour perimeter protection, DMP offers the momentary bypass feature.

DMP ZONE EXPANSION MODULES

- Provides Class B zones for burglary and fire
- Compatible with DMP Panels that allow zone expansion
- Suitable for mounting near protection devices
- Connect devices using 4-wire bus
- Compatible with all panel zone types
- Easy connection to 4-wire Keypad or LX-Bus™
- Proven design ensures stability and performance
- Data LED on zone expander indicates good panel communication
- Durable and attractive plastic or metal housing
- Low current draw
- Can be powered from panel or auxiliary power supply

505 SERIES DMP POWER SUPPLY

- Regulated and filtered power system
- Power-indicating LEDs
- Built-in overload protection
- Battery backup/charging circuit ,5 Amp output , 12 VDC power supplies
- Battery cutoff to prevent deep discharge of batteries

C100STE SERIES NAPCO DUAL MOTION DETECTOR

- Broad range and wide angle coverage suitable for most residential & commercial installations worldwide
- Patented Adaptive® technology continuously monitors and dynamically self-adjusts the sensor to its environment.
- Smart microprocessor-based false alarm discrimination.
- Dual technology microwave and PIR signal verification.
- Optimized field-of-view with custom-engineered aspheric optics.
- Tamper/Vandalism Supervision.
- Added False Alarm Prevention Features.
- Microprocessor: 2K ROM with A-D Converter
- Self-Test Interval: 11 - 16 hrs. •
- Power supply requirements: Filtered 10.6 to 16VDC nominal with battery backup form the control panel.
- Current drain: 28mA (idle/alarm) at 12VDC (nominal)

SD-70/SD-80 TANE ALARM PRODUCT RECESSED CONTACT

- (Steel Door) – New Stubby Style with 1 ½” Gap
- Rugged one piece construction
- Sensitive "No stick" UL rhodium reed
- Long leads bent to keep solder off the glass of the reed

- Two Solder points on 22 AWG 7 stranded UL Wire
- Thick plastic shell to prevent crushing
- 12" leads std. Longer leads available

1386/10 HID ISOPROXII CARD (10 PKG)

 ISOProx II is extremely thin, durable, and the size of a credit card. Passive, no-battery design allows an infinite number of reads. Provided blank for customization or badging applications

1346/100 HID PROXKEY III ACCESS DEVICE (1 set of 50)

 Impact resistant construction, standard key size, and consistent read capability make the HID ProxKey III an ideal choice for an unobtrusive access device. Can be installed on key ring for convenience.

1100XH DMP 1100 Series WIRELESS HIGH POWER RECEIVER (1 each)

 Receivers allow you to add wireless transmitters to DMP panels as easily as adding a keypad.

 Supporting up to 500 wireless transmitters

1100R DMP 1100 Series WIRELESS REPEATER (5 each)

 Extend the communication range of DMP wireless devices with the **1100R** Wireless Repeater. Refer to plan for location.

 Use up to eight 1100R repeaters with any DMP 1100 Series Receiver system.

 The plug-in DC power supply is backed up by a 24-hour battery.

 On-board LEDs provide built-in survey capability to enable single-person installation and eliminating the requirement for an external survey kit.

 An internal case tamper switch provides device security.

1145-4-B DMP KEY FOB TRANSMITTER (2 each)

 The Key Fob transmitters are portable, water resistant, and designed to be clipped to a keychain or lanyard.

 The key fob LED provides visual acknowledgement when a button is pressed and responds to each separate operation with specific color-coded LED status displays.

NOTE:

 All door contacts needs to be program for both security and door annunciation

 The WiFi system and panic transmitters needs to be program as a panic system as provided by the security panel.

 Programming of zones for the security system needs to be clarified by the Owner.

- Programming of all the special systems needs to be approved prior to final configuration.
- Vendor must program the proxies as requested by the Owner.

END OF SECTION

SECTION 28 31 11
ADDRESSABLE FIRE ALARM SYSTEM

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Refer to the electrical sections.

1.2 DESCRIPTION

A. The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.

B. The facility shall have an emergency voice alarm communication system. Digitally stored message sequences shall notify the building occupants that a fire or life safety condition has been reported. Message generator(s) shall be capable of automatically distributing up to eight (8) simultaneous, unique messages to appropriate audio zones within the facility based on the type and location of the initiating event. The Fire Command Center (FCC) shall also support Emergency manual voice announcement capability for both system wide or selected audio zones, and shall include provisions for the system operator to override automatic messages system wide or in selected zones.

C. The system shall be support additional, alternate Fire Command Centers, which shall be capable of simultaneous monitoring of all system events. Alternate Fire Command Centers shall also support an approved method of transferring the control functions to an alternate Fire Command Center when necessary. All Fire Command Centers shall be individually capable of assuming Audio Command functions such as Emergency Paging, audio zone control functions, and Firefighter's Telephone communication functions.

D. Each designated zone shall transmit separate and different alarm, supervisory and trouble signals to the Fire Command Center (FCC) and designated personnel in other buildings at the site via a multiplex communication network.

E. The fire alarm system shall be manufactured by an ISO 9001:2008 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994

F. The FACP and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof). It’s acceptable for peripheral devices to be manufactured outside of the U.S. by a division of the U.S. based parent company.

G. The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installion shall be in compliance with the UL listing.

H. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final checkout and to ensure the systems integrity.

1.3 SCOPE:

1. A. A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings. Provide labor, materials, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing additional and new devices for new OR existing building. Include all cost in bid for a complete operable code compliant fire alarm system.

B. Basic Performance:

1 1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).

2. Device Circuits (IDC) shall be wired Class A (NFPA Style D) as part of an addressable device connected by the SLC Circuit.
3. Notification Appliance Circuits (NAC) shall be wired Class A (NFPA Style Z) as part of an addressable device connected by the SLC Circuit.
4. On Style 6 or 7 (Class A) configurations a single ground fault or open circuit on the system Signaling Line Circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm.
5. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
6. Speaker circuits may be controlled by NAC outputs built into the amplifiers, which shall function as addressable points on the Digital Audio Loop.
7. NAC speaker circuits shall be arranged such that there is a minimum of one speaker circuit per floor of the building or smoke zone which ever is greater.
8. Audio amplifiers and tone generating equipment shall be electrically supervised for normal and abnormal conditions.
9. NAC speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.
10. Two-way emergency telephone communication circuits shall be supervised for open and short circuit conditions.
11. Speaker circuits shall be arranged such that there is a minimum of one speaker circuit per smoke zone.
12. Speaker circuits shall be electrically supervised for open and short circuit conditions. If a short circuit exists on a speaker circuit, it shall not be possible to activate that circuit.
13. 10. Audio amplifiers and tone generating equipment shall be electrically supervised for abnormal conditions. Digital amplifiers shall provide built-in speaker circuits, field configurable as four Class B (Style Y), or two Class A (Style Z) circuits.
14. 11. Digital amplifiers shall be capable of storing up to two minutes of digitally recorded audio messages and tones. The digital amplifiers shall also be capable of supervising the connection to the associated digital message generator, and upon loss of that connection shall be capable of one of the following system responses:
    1.
    2. a. The digital amplifier shall automatically broadcast the stored audio message.
    3. b. The digital amplifier shall switch to a mode where a local bus input on the digital amplifier will accept an input to initiate a broadcast of the stored message. This bus input shall be connected to a NAC on a local FACP for the purpose of providing an alternate means of initiating an emergency message during a communication fault condition.
    4. c. Speaker circuits shall be either 25 VRMS or 70VRMS. Speaker circuits shall have 20% space capacity for future expansion or increased power output requirements.
    5. d. Two-way emergency telephone (Fire Fighter Telephone) communication shall be supported between the Audio Command Center and up to seven (7) remote Fire Fighter's Telephone locations simultaneously on a telephone riser.
    6. e. Means shall be provided to connect FFT voice communications to the speaker circuits in order to allow voice paging over the speaker circuit from a telephone handset.
    7. f. The digital audio message generator shall be of reliable, non-moving parts, and support the digital storage of up to 32 minutes of tones and emergency messages, shall support programming options to string audio segments together to create up to 1000 messages, or to loop messages and parts of messages to repeat for pre-determined cycles or indefinitely.

1.4 GUARANTY:

A. The fire alarm control panel, voice panels and any head-end equipment shall have a manufacturer’s warranty of a minimum of 3 years.

1.5 QUALIFICATIONS:

A. The fire alarm contractor, as a business entity, shall be an authorized and designated representative of the equipment manufacturer and shall have been actively engaged in the business of selling, installation and servicing fire alarm systems for a period of at least (5)

years prior to the bid date.

B. The fire alarm contractor shall have an office within 50 miles of the job site staffed with trained technicians who are qualified to manage the installation, to be responsible that the system is installed as submitted, to conduct system start-up, to instruct the project coordinators representatives and local authorities in the proper operation of the system, and to provide service throughout the warranty period. 3. The fire alarm contractor SHALL NOT HAVE any grievances or complaints on record regarding workmanship, code compliance, or service response with either the project coordinator, Architect, Engineer, Owner or the State Fire Marshals office. A contractor that has any prior finding(s) of a Fire Alarm license violation or has any litigation in process with the State Fire Marshal is unacceptable.

3. The fire alarm contractor shall be an active installer on the approved manufacturer for a minimum of 5 years.

1.6 POST CONTRACT MAINTENANCE:

A. Complete maintenance and repair service for the fire detection system shall be available from a factory trained authorized representative of the manufacturer of the major equipment for a period of five (5) years after expiration of the guaranty.

B. As part of the bid/proposal, include a quote for a maintenance contract to provide all maintenance, required tests, and list pricing for any replacement products included on the bill of materials, along with the list pricing for products not on the bill of materials; if test and inspection rates are different than full service rates the bid/proposal shall include pricing for all levels for a minimum period of five (5) years Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

C. Include also a quote for unscheduled maintenance/repairs, including hourly rates for technicians trained on this equipment, and response travel costs for each year of the maintenance period. Submittals that do not identify all post contract maintenance costs will not be accepted. Rates and costs shall be valid for the period of five (5) years after expiration of the guaranty.

1.7 APPLICABLE STANDARDS AND SPECIFICATIONS:

A. The specifications and standards listed below form a part of this specification. The system shall fully comply with the latest issue of these standards, if applicable.

B. National Fire Protection Association (NFPA) - USA:

No. 12	Extinguishing Systems (low and high)
No. 12A	Halon 1301 Extinguishing Systems
No. 13	Sprinkler Systems
No. 15	Water Spray Systems
No. 16	Foam / Water Deluge and Spray Systems
No. 17	Dry Chemical Extinguishing Systems
No. 17A	Wet Chemical Extinguishing Systems
No. 2001	Clean Agent Extinguishing Systems
No. 70	National Electric Code
No. 90A	Air Conditioning Systems
No. 92A	Smoke Control Systems
No. 92B	Smoke Management Systems in Malls, Atria, Large Areas
No. 72	National Fire Alarm Code
No. 101	Life Safety Code

C. Underwriters Laboratories Inc. (UL) - USA:

No. 268	Smoke Detectors for Fire Protective Signaling Systems
No. 864	Control Units for Fire Protective Signaling Systems
No. 2572	Mass Notification Systems
No. 217	Smoke Detectors, Single and Multiple Station
No. 228	Door Closers - Holders for Fire Protective Signaling Systems
No. 268A	Smoke Detectors for Duct Applications
No. 521	Heat Detectors for Fire Protective Signaling Systems

No. 464	Audible Signaling Appliances
No. 38	Manually Actuated Signaling Boxes
No. 1481	Power Supplies for Fire Protective Signaling Systems
No. 346	Waterflow Indicators for Fire Protective Signaling Systems
No. 1076	Control Units for Burglar Alarm Proprietary Protective Signaling Systems
No. 1971	Visual Notification Appliances
No. 2017	Standard for General-Purpose Signaling Devices and Systems
No.60950	Safety of Information Technology Equipment

D. Local and State Building Codes.

E. All requirements of the Authority Having Jurisdiction (AHJ).

1.8 APPROVALS:

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:

UL Underwriters Laboratories, Inc
ULC Underwriters Laboratories Canada
FM Factory Mutual
FM 6320 Factory Mutual Gas Detection System
NYFD New York Fire Department
CSFM California State Fire Marshal

The system shall be listed by the national agencies as suitable for extinguishing release applications. The system shall support release of low pressure CO2.

B. The system shall be certified for seismic applications in accordance with the International Building Code (IBC). For OSHPD applications in California the system shall be Pre-Approved for seismic applications. The basis for qualification of seismic approval shall be via shake table testing.

C. The system shall be approved for Marine Applications and carry the following certifications:

1. USCG United States Coast Guard
2. Lloyd's Register
3. ABS American Bureau of Shipping

D. The System shall be FM 6320 (Factory Mutual) approved as a Gas Detection system when employed with the FMM-4-20 monitor module and industry standard 4-20 mA gas detectors.

1.11 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with NFPA 72 and all contract documents and specification requirements.

B. All interconnections between this system and the monitoring system shall be arranged so that the entire system can be UL-Certificated.

C. System shall be a complete, supervised, non-coded, addressable multiplex fire alarm system conforming to NFPA 72.

D. The system shall have Style 4 circuits for each floor. The system shall operate in the alarm mode upon actuation of any alarm initiating device. The system shall remain in the alarm mode until all initiating device(s) are reset and the fire alarm control panel is manually reset and restored to normal.

E. The system shall be capable of the following configurations. Both configurations are permitted on the same network.

1. The system shall support up to 252 addressable devices, which may be divided in any ratio on one, two, three, or four separate, isolated Class B circuits.

2. The system shall support two loops of 252 addressable devices, each of which may be divided in any ratio on one, two, three, or four separate, isolated Class B circuits.

F. The system shall support H-series devices and Cerberus PRO series devices

G. The system shall have an optional digital alarm communication transmitter.

H. The system shall provide an off-normal warning prior to reset for all active devices.

I. The system shall be capable of remote monitoring via Cerberus Remote, a proprietary software system that provides a graphical representation of the fire alarm control panel at a remote PC when connected via Ethernet to the system. The display will show the exact state of the panel, including blinking LEDs, and with menu buttons for control.

J. The system shall be capable of being configured via a PC Tool.

K. In networked systems, each of 4 control panels shall be configurable to be a global annunciator, capable of viewing all other control panels on the network.

L. The system shall provide the following functions and operating features:

1. The FACP and auxiliary power panels shall provide power, annunciation, supervision and control for the system.

2. Provide Class B initiating device circuits.

3. Provide Style 4 signaling line circuits for the network.

4. Provide two Class B notification appliance circuits. Arrange circuits to allow individual, selective, and visual notification by zone. Notification appliance circuits shall be zoned to correspond with the building fire barriers and other building features.

5. NACs shall be synchronized throughout the entire building.

6. Provide electrical supervision of the primary power (AC) supply, presence of the battery, battery voltage, and placement of system modules within the control panel.

M. The system shall provide a field test function where one person can test the complete system or a specific area while maintaining full operational function of other areas not being tested. Alarms, supervisory signals, trouble signals shall be logged in system history during the walk-test.

N. Alarm functions shall override trouble or supervisory functions. Supervisory functions shall override trouble functions.

O. Fire alarm signal initiation shall be by one or more of the following devices:

1. Manual pull station

2. Heat detector

3. Addressable area smoke detectors

4. Addressable Multi-criteria, dual optical smoke detectors

5. Standard Addressable Duct smoke detector

6. Specialized Duct Smoke detector

7. Projected beam detector

8. Automatic sprinkler system water flow switch.

P. Activation of any system fire, security, supervisory, trouble, or status initiating device shall cause the following actions and indications at all network Person Machine Interfaces using an LCD display with multiple detail screens.

1. Fire Alarm Condition:

1) Sound an audible alarm and display a custom message defining the building in alarm and the specific alarm point initiating the alarm on an LCD display.

2) Log into the system history archives all activity pertaining to the alarm condition.

3) Sound the ANSI 117-1 signal with synchronized audible notification appliances and synchronized strobes throughout the facility.

4) Audible signals shall be silenced from the fire alarm control panel by an alarm silence switch. Visual signals shall be programmable to flash until system reset or alarm silencing, as required.

5) A signal dedicated to sprinkler system water flow alarm shall not be silenced while the sprinkler system is flowing at a rate of flow equal to a single head.

6) Activation of any smoke detector in a single elevator lobby or an elevator equipment room shall, in addition to the actions described, cause the recall of that bank of elevators to the 1st floor and the lockout of controls. In the event of recall initiation by a detector in the first floor lobby, the recall shall be to the alternate floor as determined by the AHJ.

7) Where indicated on drawings heat detectors in elevator shaft and machine rooms shall activate an elevator power shunt trip breaker. The heat detectors shall be rated at a temperature below the ratings of the sprinkler heads in respective locations to insure that the power shall be shut off before activation of sprinkler system.

8) System operated duct detectors as per local requirements shall accomplish HVAC shut down.

9) Door closure devices shall operate by floor or by local requirements.

2. Supervisory Condition:

1) Display the origin of the supervisory condition report at the local fire alarm control panel LCD display.

2) Activate supervisory audible and dedicated visual signal.

3) Audible signals shall be silenced from the control panel by the supervisory acknowledge switch.

4) Record within system history the initiating device and time of occurrence of the event.

3. Trouble Condition

1) Display at the local fire alarm control panel LCD display, the origin of the trouble condition report.

2) Activate trouble audible and visual signals at the control panel and as indicated on the drawings.

3) Audible signals shall be silenced from the fire alarm control panel by a trouble acknowledge switch.

4) Trouble conditions that have been restored to normal shall be automatically removed from the trouble display queue and not require operator intervention. This feature shall be software selectable and shall not preclude the logging of trouble events to the historical file.

5) Trouble reports for primary system power failure to the master control shall be automatically delayed for a period of time equal to 25% of the system standby battery capacity to eliminate spurious reports as a result of power fluctuations.

6) Record within system history, the occurrence of the event, the time of occurrence and the device initiating the event.

Q. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1.11 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories. Complete manufacturer's catalog data including supervisory power usage, alarm power usage, physical dimensions, and finish and mounting requirements.

B. Power calculations. Battery capacity calculations. Battery size shall be a minimum of 125% of the calculated requirement. Provide the following supporting information:

1. Supervisory power requirements for all equipment.

2. Alarm power requirements for all equipment.

3. Power supply rating justification showing power requirements for each of the system power supplies. Power supplies shall be sized to furnish the total connected load in a worst-case condition plus 25% spare capacity.

4. Voltage drop calculations for wiring runs demonstrating worst-case condition.

5. NAC circuit design shall incorporate a 15% spare capacity for future expansion.

C. Submit manufacturer's requirements for testing Signaling Line Circuits and device addresses prior to connecting to control panel. At a minimum the following tests shall be required; device address, the usage (Alarm, Supervisory etc), environmental compensation, temperature ratings for thermal detectors and smoke detector sensitivities. This requirement shall need approval before any wiring is connected to the control panel.

D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Wiring Diagrams: For power, signal, and control wiring.

3. Complete drawings covering the following shall be submitted by the contractor for the proposed system:

1) Floor plans in a CAD compatible format at a scale of 1/8"=1'-0" showing all equipment and raceways, marked for size, conductor count with type and size, showing the percentage of allowable National Electric Code fill used.

2) Provide a fire alarm system function matrix as referenced by NFPA 72, Figure A-7-5.2.2 (9). Matrix shall illustrate alarm input/out events in association with initiation devices. Matrix summary shall include system supervisory and trouble output functions. Include any and all departures, exceptions, variances or substitutions from these specifications and/or drawings at time of bid.

4. Installation drawings shop drawings, and as-built drawings shall be prepared by an individual experienced with the work specified herein.

5. Incomplete submittals shall be returned without review, unless with prior approval of the Engineer.

E. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Light fixtures.

2. HVAC registers

3. Fire protection equipment interfaces

4. Special suppression system interfaces

F. Qualification Data: For qualified Installer, Applicator, manufacturer, fabricator, professional engineer, testing agency, and factory-authorized service representative.

G. Source quality-control reports.

H. Field quality-control reports.

I. Operation and Maintenance Data: For all fire alarm equipment, to include in operation and maintenance manuals.

J. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.

2. Program Software Backup: On magnetic media or compact disk, complete with data files.

3. Device address list.

4. Printout of software application and graphic screens.

K. Warranty: Sample of special warranty.

1.11 QUALITY ASSURANCE

A. Manufacturer Qualifications: The publications listed below form a part of this publication to the extent referenced. The publications are referenced in the text by the basic designation only. The latest version of each listed publication shall be used as a guide unless the authority having jurisdiction has adopted an earlier version.

1. FM Global (Factory Mutual (FM)):FM Approval Guide

2. National Fire Protection Association (NFPA)

1) NFPA 70 National Electrical Code

2) NFPA 72 National Fire Alarm Code

3) NFPA 90A Standard For The Installation of Air Conditioning and Ventilating Systems

4) NFPA 101 Life Safety Code

3. Underwriters' Laboratories, Inc. (UL) equipment standards, Latest Edition

1) UL Fire Protection Equipment Directory

2) UL Electrical Construction Materials Directory

3) UL 38 – Manually Actuated Signaling Boxes for Use With Fire Protection Signaling Systems

4) UL 228 – Door Holding Devices

5) UL 268 - Smoke Detectors for Fire Protective Signaling Systems

6) UL 268A - Smoke Detectors for Duct Application

7) UL 464 - Audible Signal Appliances

8) UL 497A – Secondary Protectors for Communications Circuits

9) UL 521 - Heat Detectors for Fire Protective Signaling Systems

10) UL 864 - Control Units for Fire Protective Signaling Systems

11) UL 1283 – Electromagnetic Interference Filters

12) UL 1449 - Transient Voltage Surge Suppressors

13) UL 1971 - Signaling Devices for the Hearing Impaired

14) UL 2075 – Gas and Vapor Detectors and Sensors

15) UL 2572 – Mass Notification Systems

4. International Code Council

1) International Building Code

2) International Fire Code.

5. State and Local Building Codes as adopted and/or amended by The Authority Having Jurisdiction, ADA, and/or State and local equivalency standards as adopted by The Authority Having Jurisdiction.

6. California State Fire Marshal

7. NY-MEA

8. The manufacturer shall have a minimum of 15 years production experience in the manufacture and design of high sensitivity aspiration-type smoke detection systems.

9. ISO 9002

B. Supplier Qualifications

1. The manufacturer of the supplied products must utilize multi-channel product distribution on a national basis to be considered for this bid.

2. Provide the services of a factory trained and certified representative or technician, experienced in the installation and operation of the type of system provided. The representative shall be licensed in the State if required by law.

3. The technician shall supervise installation, software documentation, adjustment, preliminary testing, final testing and certification of the system. The technician shall provide the required instruction to the owner's personnel in the system operation and maintenance.

4. The suppliers shall furnish evidence they have an experienced service organization, which carries a stock of spare and repair parts for the system being furnished.

5. The equipment supplier shall be authorized and trained by the manufacturer to calculate, design, install, test, and maintain the air sampling system and shall be able to produce a certificate stating such upon request.

C. Installer Qualifications:

1. Before commencing work, submit data showing that the manufacturer has successfully installed fire alarm systems of the same scope, type and design as specified.

2. The contractor shall submit copies of all required Licenses and Bonds as required in the State having jurisdiction.

3. The contractor shall employ on staff a minimum of one NICET level II technician or a professional engineer, registered in the State of the installation.

4. The contractor shall be qualified by UL for certifying fire alarm systems.

5. Contractors unable to comply with the provisions of Qualification of Installers shall present proof of engaging the services of a subcontractor qualified to furnish the required services.

6. The fire alarm contractor as a business entity shall be an authorized and designated representative of the equipment manufacturer and shall have been actively engaged in the business of selling, installation and serving fire alarm systems for a period of at least (5) years prior to bid date.

7. The fire alarm contractor shall have an office within 50 miles of the job site staffed with trained technicians who are qualified to manage the installation, to be responsible that the system is installed as submitted, to conduct system start-up, to instruct the project coordinators representatives and local authorities in the proper operation of the system and to provide service throughout the warranty period.

8. The fire alarm contractor SHALL NOT HAVE any grievances or complaints on record regarding workmanship code compliance or service response with either the project coordinator Engineer, Owner or the State Fire Marshals office. A contract that any prior findings of a Fire Alarm license violation or has any litigation in process with the State Fire Marshall is UNACCEPTABLE.

9. The fire alarm contractor shall be an active installer on the approved manufacturer for a minimum of 5 years.

PART 2.0 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

1. Basis of Design - Notifier

2. If equipment of another manufacturer is to be submitted for approval as equal, the contractor shall list all exceptions taken to these specifications, all variances from these specifications and all substitutions of operating

capabilities or equipment called for in these specifications and forward said list to Engineer ten (10) days prior to bid. Any such exception, variances or substitutions that were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval without comment. Final determination with this specification shall rest with the Engineer, who at his discretion may require proof of performance.
3. Other acceptable manufacturers: Silent Knight 6820 EVS - Voice Evac system and Siemens

MAIN FIRE ALARM CONTROL PANEL OR NETWORK NODE:

A. Main FACP or network node shall contain a microprocessor based Central Processing Unit (CPU) and power supply. The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, printer, annunciators, and other system controlled devices.

B. In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the main FACP shall perform the following functions:

1. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
2. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to addressable monitor and control modules.
3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed. In the event of CPU failure, all SLC loop modules shall fallback to degrade mode. Such degrade mode shall treat the corresponding SLC loop control modules and associated detection devices as conventional two-wire operation. Any activation of a detector in this mode shall automatically activate associated Notification Appliance Circuits.

2.2 SYSTEM CAPACITY AND GENERAL OPERATION

A. The FACP shall be capable of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels / nodes per network.

B. The control panel shall be capable of expansion via up to 10 SLC loops. Each module shall support up to 318 analog/addressable devices for a maximum system capacity of 3180 points. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit 640-character liquid crystal display, individual, color coded system status LEDs, and a keypad for the control of the fire alarm system. Said LCD shall also support graphic bit maps capable of displaying the company name and logo of either thpany.
C. All programming or editing of the existing program in the system shall be achieved without interrupting the alarm monitoring functions of the fire alarm control panel.

D. The FACP shall be able to provide the following software and hardware features:

1. Pre-signal and Positive Alarm Sequence: The system shall provide means to cause alarm signals to only sound in specific areas with a delay of the alarm from 60 to up to 180 seconds after start of alarm processing. In addition, a Positive Alarm Sequence selection shall be available that allows a 15-second time period for acknowledging an alarm signal from a fire detection/initiating device. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.
2. Smoke Detector Pre-alarm Indication at Control Panel: To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real-time detector sensing values above the programmed setting. Two levels of Pre-alarm indication shall be available at the control panel: alert and action.
3. Alert: It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated.
4. Action: If programmed for Action and the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder bases installed with

either heat or smoke detectors shall automatically activate on action Pre-Alarm level, with general evacuation on Alarm level.

5. The system shall support a detector response time to meet world annunciation requirements of less than 3 seconds.

6. Device Blink Control: Means shall be provided to turn off detector/module LED strobes for special areas.

7. NFPA 72 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meets the sensitivity testing requirements of NFPA 72.

8. Programmable Trouble Reminder: The system shall provide means to automatically initiate a reminder that troubles exist in the system. The reminder will appear on the system display and (if enabled) will sound a piezo alarm.

9. On-line or Off-line programming: The system shall provide means to allow panel programming either through an off-line software utility program away from the panel or while connected and on-line. The system shall also support upload and download of programmed database and panel executive system program to a Personal Computer/laptop. A single change to one CPU database shall not require a database download to other CPUs.

10. History Events: The panel shall maintain a history file of the last 4000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries. The control panels shall also maintain a 1000 event Alarm History buffer, which consists of the 1000 most recent alarm events from the 4000 event history file.

11. Smoke Control Modes: The system shall provide means to perform FSCS mode Smoke Control to meet NFPA-92A and 90B and HVAC mode to meet NFPA 90A.

12. The system shall provide means for all SLC devices on any SLC loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.

13. Passwords and Users: The system shall support two password levels, master and user. Up to 9 user passwords shall be available, each of which may be assigned access to the programming change menus, the alter status menus, or both. Only the master password shall allow access to password change screens.

14. Block Acknowledge: The system shall support a block Acknowledge for Trouble Conditions

15. Sensitivity Adjust: The system shall provide Automatic Detector Sensitivity Adjust based on Occupancy schedules including a Holiday list of up to 15 days.

16. Environmental Drift Control: The system shall provide means for setting Environmental Drift Compensation by device. When a detector accumulates dust in the chamber and reaches an unacceptable level but yet still below the allowed limit, the control panel shall indicate a maintenance alert warning. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.

17. Custom Action Messages: The system shall provide means to enter up to 100 custom action messages of up to 160 characters each. It shall be possible to assign any of the 100 messages to any point.

18. Local Mode: If communication is lost to the central processor the system shall provide added survivability through the intelligent loop control modules. Inputs from devices connected to the SLC and loop control modules shall activate outputs on the same loop when the inputs and outputs have been set with point programming to participate in local mode or when the type codes are of the same type: that is, an input with a fire alarm type code shall activate an output with a fire alarm type code.

19. Read status preview - enabled and disabled points: Prior to re-enabling points, the system shall inform the user that a disabled device is in the alarm state. This shall provide notice that the device must be reset before the device is enabled thereby avoiding activation of the notification circuits.

20. Custom Graphics: When fitted with an LCD display, the panel shall permit uploading of a custom bit-mapped graphic to the display screen.

21. Multi-Detector and Cooperating Detectors: The system shall provide means to link one detector with up to two detectors at other addresses on the same loop in cooperative multi-detector sensing. There shall be no requirement for sequential addresses on the detectors and the alarm event shall be a result ofall cooperating detectors chamber readings.

22. ACTIVE EVENT: The system shall provide a Type ID called FIRE CONTROL for purposes of air-handling shutdown, which shall be intended to override normal operating automatic

functions. Activation of a FIRE CONTROL point shall cause the control panel to (1) initiate the monitor module Control-by-Event, (2) send a message to the panel display, history buffer, installed printer and annunciators, (3) shall not light an indicator at the control panel, (4) Shall display ACTIVE on the LCD as well a display a FIRE CONTROL Type Code and other information specific to the device.

23. NON-FIRE Alarm Module Reporting: A point with a type ID of NON-FIRE shall be available for use for energy management or other non-fire situations. NON-FIRE point operation shall not affect control panel operation nor shall it display a message at the panel LDC. Activation of a NON-FIRE point shall activate control by event logic but shall not cause any indication on the control panel.

24. Mass Notification Override:The system shall be UL 2572 listed for Mass Notification and shall be capable, based on the Risk Analysis, of being programmed so that Mass Notification/Emergency Communications events take precedence over fire alarm events.

25. Security Monitor Points: The system shall provide means to monitor any point as a type security.

26. One-Man Walk Test: The system shall provide both a basic and advanced walk test for testing the entire fire alarm system. The basic walk test shall allow a single operator to run audible tests on the panel. All logic equation automation shall be suspended during the test and while annunciators can be enabled for the test, all shall default to the disabled state. During an advanced walk test, field-supplied output point programming will react to input stimuli such as CBE and logic equations. When points are activated in advanced test mode, each initiating event shall latch the input. The advanced test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device and wiring operation/verification.

27. Control By Event Functions: CBE software functions shall provide means to program a variety of output responses based on various initiating events. The control panel shall operate CBE through lists of zones. A zone shall become listed when it is added to a point's zone map through point programming. Each input point such as detector, monitor module or panel circuit module shall support listing of up to 10 zones into its programmed zone map.

28. Permitted zone types shall be general zone, releasing zone and special zone. Each output point (control module, panel circuit module) can support a list of up to 10 zones including general zone, logic zone, releasing zone and trouble zone. It shall be possible for output points to be assigned to list general alarm. Non-Alarm or Supervisory points shall not activate the general alarm zone.

29. 1000 General Zones: The system shall support up to 1000 general purpose software zones for linking inputs to outputs. When an input device activates, any general zone programmed into that device's zone map will be active and any output device that has an active general zone in its map will be active. It shall also be possible to use general zone as arguments in logic equations.

30. 1000 Logic Equations: The system shall support up to 1000 logic equations for AND, OR, NOT, ONLY1, ANYX, XZONE or RANGE operators that allow conditional I/O linking. When any logic equation becomes true, all output points mapped to the logic zone shall activate.

31. 100 trouble equations per device: The system shall provide support for up to 100 trouble equations for each device, which shall permit programming parameters to be altered, based on specific fault conditions. If the trouble equation becomes true, all output points mapped to the trouble zone shall activate.

32. Control-By-Time: A time based logic function shall be available to delay an action for a specific period of time based upon a logic input with tracking feature. A latched version shall also be available. Another version of this shall permit activation on specific days of the week or year with ability to set and restore based on a 24 hour time schedule on any day of the week or year.

33. Multiple agent releasing zones: The system shall support up to 10 releasing zones to protect against 10 independent hazards. Releasing zones shall provide up to three cross-zone and four abort options to satisfy any local jurisdiction requirements.

34. Alarm Verification, by device, with timer and tally: The system shall provide a user-defined global software timer function that can be set for a specific detector. The timer function shall delay an alarm signal for a user-specified time period and the control panel shall ignore the alarm verification timer if another alarm is detected during the verification period. It shall also be possible to set a maximum verification count between 0 and 20 with the "0" setting producing no alarm verification. When the counter exceeds the threshold value entered, a trouble shall be generated to the panel.

E. Network Communication

1. The FACP shall be capable of communicating on Noti-Fire-Net over a Local Area Network (LAN) or Wide Area Network (WAN) utilizing a peer-to-peer, inherently regenerative communication format and protocol. The network shall support communication speed up to 100 Mb and support up to 200 panels/nodes per network.

F. Central Processing Unit

1. The Central Processing Unit shall contain and execute all control-by-event (including Boolean functions including but not limited to AND, OR, NOT, ANYx, and CROSSZONE) programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power failure.
2. The Central Processing Unit shall also provide a real-time clock for time annotation, to the second, of all system events. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.
3. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.
4. The CPU shall provide an EIA-232 interface between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals.
5. The CPU shall provide two EIA-485 ports for the serial connection to annunciation and control subsystem components.
6. The EIA-232 serial output circuit shall be optically isolated to assure protection from earth ground.

G. Display

1. The system display shall provide a 640-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide eleven Light-Emitting-Diodes (LEDs) that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM, SECURITY, SUPERVISORY, SYSTEM TROUBLE, OTHER EVENT, SIGNALS SILENCED, POINT DISABLED, CONTROLS ACTIVE, and CPU FAILURE.
2. The system display shall provide a keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels with up to ten (one Master and nine User) passwords shall be accessible through the display interface assembly to prevent unauthorized system control or programming.

H. Loop (Signaling Line Circuit) Control Module:

1. The Loop Control Module shall monitor and control a minimum of 318 intelligent addressable devices. This includes 159 intelligent detectors (Ionization, Photoelectric, or Thermal) and 159monitor or control modules.
2. The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.
3. Each Loop shall be capable of operating as a NFPA Style 4 (Class B) circuit.
4. The SLC interface board shall receive analog or digital information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular device. Each SLC Loop shall be isolated and equipped to annunciate an Earth Fault condition. The SLC interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.

I. Digital Voice Command Center

1. The Digital Voice Command Center located with the FACP, shall contain all equipment required for all audio control, emergency telephone system control, signaling and supervisory functions. This shall include speaker zone indication and control, telephone circuit indication and control, digital voice units, microphone and main telephone handset.
2. Function: The Voice Command Center equipment shall perform the following functions:

a. Operate as a supervised multi-channel emergency voice communication system.
Operate as a two-way emergency telephone system control center.
b. Audibly and visually annunciate the active or trouble condition of every speaker circuit and emergency telephone circuit.
c. Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.
d. Provide all-call Emergency Paging activities through activation of a single control switch.
e. As required, provide vectored paging control to specific audio zones via dedicated control switches.
f. Provide a factory recorded "library" of voice messages and tones in standard WAV. File format, which may be edited and saved on a PC running a current Windows® operating system.
g. Provide a software utility capable of off-line programming for the DVC operation and the audio message files. This utility shall support the creation of new programs as well as editing and saving existing program files. Uploading or downloading the DVC shall not inhibit the emergency operation of other nodes on the fire alarm network.
h. Support an optional mode of operation with four analog audio outputs capable of being used with UL 864 fire-listed analog audio amplifiers and SLC controlled switching.
i. The Digital Voice Command shall be modular in construction, and shall be capable of being field programmable without requiring the return of any components to the manufacturer and without requiring use of any external computers or other programming equipment.
j. The Digital Voice Command and associated equipment shall be protected against unusually high voltage surges or line transients.

J. Power Supply:

1. The Main Power Supply shall operate on 120/240 VAC, 50/60 Hz, and shall provide all necessary power for the FACP.
2. The Main Power Supply shall provide the required power to the CPU using a switching 24 VDC regulator and shall incorporate a battery charger for 24 hours of standby power using dual-rate charging techniques for fast battery recharge.
3. The Main Power Supply shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge. The supply shall be capable of charging batteries ranging in capacity from 7-200 amp-hours within a 48-hour period.
4. The Main Power Supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
5. The Main Power Supply shall be power-limited per UL864 requirements.
6. The Main Power Supply shall communicate power supply, line voltage, battery status and charger status to the local LCD display. Any abnormal condition shall be annunicated and logged to the system alarm history log.
7. Addressable Charger Power SupplyThe auxiliary addressable power supply is a remote 24 VDC power supply used to power Notification Devices and field devices that require regulated 24 VDC power. .
8. The addressable power supply for the fire detection system shall provide up to a minimum of 6.0 amps of 24 volt DC regulated power for Notification Appliance Circuit (NAC) power or 10.0 amps of 24 volt DC general power. The power supply shall have an additional 0.5 amp of 24 VDC auxiliary power for use within the same cabinet as the power supply. It shall include an integral charger designed to charge 12 - 200 amp hour batteries.
9. The addressable power supply shall provide four individually addressable Notification Appliance Circuits that may be configured as Class "A" or Class "B" circuits. All circuits shall be power-limited per UL 864 requirements.

10. The addressable power supply shall provide built-in synchronization for certain Notification Appliances on each circuit without the need for additional synchronization modules. The power supply's output circuits shall be individually selected for synchronization. A single addressable power supply shall be capable of supporting both synchronized and non-synchronized Notification Devices at the same time.
11. The addressable power supply shall operate on 120 or 240 VAC, 50/60 Hz.
12. The interface to the power supply from the Fire Alarm Control Panel (FACP) shall be via the Signaling Line Circuit (SLC) or other multiplexed means Power supplies that do not use an intelligent interface are not suitable substitutes. The required wiring from the FACP to the addressable power supply shall be a single unshielded twisted pair wire.
13. The addressable power supply shall supervise for battery charging failure, AC power loss, power brownout, battery failure, NAC loss, and optional ground fault detection. In the event of a trouble condition, the addressable power supply shall report the incident and the applicable address to the FACP via the SLC.
14. The addressable power supply shall have an AC Power Loss Delay option. If this option is utilized and the addressable power supply experiences an AC power loss, reporting of the incident to the FACP will be delayed. A delay time of zero, two, eight or sixteen hours shall be programmable.
15. The addressable power supply shall have an option for Canadian Trouble Reporting and this option shall be programmable.
16. The addressable power supply mounts in either the FACP backbox or it's own dedicated surface mounted backbox with cover.
17. Each of the power supply's four output circuits shall be programmed- for Notification Appliance Circuit or General Purpose 24 VDC power. Any output circuit shall be able to provide up to 2.5 amps of 24 VDC power.
18. The addressable power supply's output circuits shall be individually supervised when they are selected to be either a Notification Appliance Circuit when wired Class "A" or by the use of and end-of-line resistor. When the power supply's output circuit is selected as General 24 VDC power, the circuit shall be individually supervised when an end-of-line relay is used.
19. When selected for Notification Appliance Circuits, the output circuits shall be individually programmable for Steady, March Time, Dual Stage or Temporal.
20. When selected as a Notification Appliance Circuit, the output circuits of the addressable power supply shall have the option to be coded by the use of a universal zone coder.
21. The addressable power supply shall interface and synchronize with other power supplies of the same type. The required wiring to interface multiple addressable power supplies shall be a single unshielded, twisted pair wire.
22. An individual or multiple interfaced addressable power supplies shall have the option to use an external charger for battery charging. Interfaced power supplies shall have the option to share backup battery power.

K. Audio Amplifiers

1. The Audio Amplifiers will provide Audio Power () for distribution to speaker circuits.
2. Multiple audio amplifiers may be mounted in a single enclosure, either to supply incremental audio power, or to function as an automatically switched backup amplifier(s).
3. The audio amplifier shall include an integral power supply, and shall provide built-in LED indicators for the following conditions:

a. Earth Fault on DAP A (Digital Audio Port A)
b. Earth Fault on DAP B (Digital Audio Port B)
c. Audio Amplifier Failure Detected Trouble
d. Active Alarm Bus input
e. Audio Detected on Aux Input A
f. Audio Detected on Aux Input B
g. Audio Detected on Firefighter's Telephone Riser
h. Receiving Audio from digital audio riser
i. Short circuit on speaker circuit 1
j. Short circuit on speaker circuit 2
k. Short circuit on speaker circuit 3

l. Short circuit on speaker circuit 4
m. Data Transmitted on DAP A
n. Data Received on DAP A
o. Data Transmitted on DAP B
p. Data Received on DAP B
q. Board failure
r. Active fiber optic media connection on port A (fiber optic media applications)
s. Active fiber optic media connection on port B (fiber optic media applications)
t. Power supply Earth Fault
u. Power supply 5V present
v. Power supply conditions - Brownout, High Battery, Low Battery, Charger Trouble

4. The audio amplifier shall provide the following built-in controls:

a. Amplifier Address Selection Switches
b. Signal Silence of communication loss annunciation Reset
c. Level adjustment for background music
d. Enable/Disable for Earth Fault detection on DAP A
e. Enable/Disable for Earth Fault detection on DAP A
f. Switch for 2-wire/4-wire FFT riser

5. Adjustment of the correct audio level for the amplifier shall not require any special tools or test equipment.
6. Includes audio input and amplified output supervision, back up input, and automatic switch over function, (if primary amplifier should fail).
7. System shall be capable of backing up digital amplifiers.
8. One-to-one backup shall be provided by either a plug-in amplifier card or a designated backup amplifier of identical model as the primary amplifier.
9. One designated backup amplifier shall be capable of backing up multiple primary amplifiers mounted in the same or adjacent cabinets.
10. Multi-channel operation from a single amplifier shall be supported by the addition of an optional plug-in amplifier card.

L. Audio Message Generator (Prerecorded Voice)/Speaker Control:

1. Each initiating zone or intelligent device shall interface with an emergency voice communication system capable of transmitting a prerecorded voice message to all speakers in the building.
2. Actuation of any alarm initiating device shall cause a prerecorded message to sound over the speakers. The message shall be repeated four (4) times. Pre- and post-message tones shall be supported.
3. A built-in microphone shall be provided to allow paging through speaker circuits.
4. System paging from emergency telephone circuits shall be supported.
5. The audio message generator shall have the following indicators and controls to allow for proper operator understanding and control:

a. Lamp Test
b. Trouble
c. Off-Line Trouble
d. Microphone Trouble
e. Phone Trouble
f. Busy/Wait
g. Page Inhibited
h. Pre/Post Announcement Tone

M. Controls with associated LED Indicators:

1. Speaker Switches/Indicators

a. The speaker circuit control switches/indicators shall include visual indication of active and trouble status for each speaker circuit in the system.
b. The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.\

2. Emergency Two-Way Telephone Control Switches/Indicators

a. The emergency telephone circuit control panel shall include visual indication of active and trouble status for each telephone circuit in the system.
b. The telephone circuit control panel shall include switches to manually activate or deactivate each telephone circuit in the system.

N. Remote Transmissions:

1. Provide local energy or polarity reversal or trip circuits as required.
2. The system shall be capable of operating a polarity reversal or local energy or fire alarm transmitter for automatically transmitting fire information to the fire department.
3. Provide capability and equipment for transmission of zone alarm and trouble signals to remote operator's terminals, system printers and annunciators.
4. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.

O. Field Programming

1. The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers, or other electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information.
2. All field defined programs shall be stored in non-volatile memory.

P. Specific System Operations

1. Smoke Detector Sensitivity Adjust: A means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the system from the system keypad. Sensitivity range shall be within the allowed UL window and have a minimum of 9 levels.
2. Alarm Verification: Each of the intelligent addressable smoke detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification delay shall be programmable from 0 to 60 seconds and each detector shall be able to be selected for verification. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

Q. System Point Operations:

1. Any addressable device in the system shall have the capability to be enabled or disabled through the system keypad or video terminal.
2. System output points shall be capable of being turned on or off from the system keypad or the video terminal.
3. Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:

1 a. Device Status.
2 b. Device Type.
3 c. Custom Device Label.
4 d. Software Zone Label.
5 e. Device Zone Assignments.
6 f. Analog Detector Sensitivity.
7 g. All Program Parameters.
8

4. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 4000 system events. Each of these events will be stored, with time and date stamp, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed; one event at a time, and the actual number of activations may also be displayed and or printed. History events shall include all alarms, troubles, operator actions, and programming entries.
5. The history buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.
6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.
7. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular Intelligent Detector will be annunciated on the system display, and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
8. The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personal when a detector is at 80% of its alarm threshold in a 60 second period.

2.3 SYSTEM COMPONENTS:

A. Conventional Aspirating Detection

1. An optional air aspiration detection system shall be available.
2. The aspirating system shall support multiple sensitivity settings.
3. The aspirating system shall operate from 24 VDC.
4. The aspirating system shall provide alarm and trouble relays used to activate a fire alarm control panel.

B. Aspiration System Interface:

1. The system shall be capable of supporting Interface Modules for integrating Vesda Aspiration detectors into SLC loop of the fire alarm control panel. The Interface Module shall support up to 19 detectors detectors, each SLC loop shall support one interface module.

C. High Level Aspiration System Interface:

1. The system shall be capable of supporting a High Level Interface for Vesda Aspirating Detection Systems. The interface shall support up to 100 detectors and allow the fire alarm network to monitor and control events on the aspiration system.

D. Portable Emergency Telephone Handset Jack

1. Portable emergency telephone handset jacks shall be flush mounted on stainless steel plates as indicated on plans. Handset jacks shall be approved for emergency telephone system application.
2. Insertion of a remote handset plug into a jack shall send a signal to the fire command center which shall audibly and visually indicate the on-line condition, and shall sound a ring indication in the handset.
3. The two-way emergency telephone system shall support a minimum of seven (7) handsets on line without degradation of the signal.

E. Fixed Emergency Telephone Handset

1. The telephone cabinet shall be painted red and clearly labeled emergency telephone. The cabinets shall be located where shown on drawings.
2. The handset cradle shall have a switch connection such that lifting the handset off of the cradle shall send a signal to the fire command center which shall audibly and visually indicate its on-line (off-hook) condition.
3. The two-way emergency telephone system shall support a maximum of seven (7) handsets on line (off hook) without degradation of the signal.

F. Universal Digital Alarm Communicator Transmitter (UDACT). The UDACT is an interface for communicating digital information between a fire alarm control panel and an UL-Listed central station.

1. The UDACT shall be compact in size, mounting in a standard module position of the fire alarm control cabinet. Optionally, the UDACT shall have the ability for remote mounting, up to 6,000 feet from the fire alarm control panel. The wire connections between the UDACT and the control panel shall be supervised with one pair for power and one pair for multiplexed communication of overall system status. Systems that utilize relay contact closures are not acceptable.
2. The UDACT shall include connections for dual telephone lines (with voltage detect), per UL/NFPA/FCC requirements. It shall include the ability for split reporting of panel events up to two different telephone numbers.
3. The UDACT shall be capable of transmitting events in 4+2, SIA, and Contact ID.
4. Communication shall include vital system status such as:

9 a. Independent Zone (Alarm, trouble, non-alarm, supervisory)
10 b. Independent Addressable Device Status
11 c. AC (Mains) Power Loss
12 d. Low Battery and Earth Fault
13 e. System Off Normal
14 f. 12 and 24 Hour Test Signal
15 g. Abnormal Test Signal (per UL requirements)
16 h. EIA-485 Communications Failure
17 i. Phone Line Failure
18

5. The UDACT shall support independent zone/point reporting when used in the Contact ID format. In this format the UDACT shall support transmission of up to 3,064 points. This enables the central station to have exact details concerning the origin of the fire or response emergency.
6. The UDACT shall be capable of being programmed with the same programming utility as the host FACP, and saved, edited and uploaded and downloaded using the utility. UDACT shall be capable of being programmed online or offline. The programming utility shall also support upgrading UDACT operating firmware.
7. The UDACT shall be capable of generating Central Station reports providing detailed programming information for each point along with the central station point address.
8. An IP or IP/GSM Communicator option shall be available to interface to the UDACT and be capable of transmitting signals over the internet/intranet or Cellular (GSM) network to a compatible receiver.

G. Field Wiring Terminal Blocks

1. For ease of service all panel I/O wiring terminal blocks shall be removable, plug-in types and have sufficient capacity for #18 to #12 AWG wire. Terminal blocks that are permanently fixed are not acceptable.

H. Printer

1. The printer shall provide hard-copy printout of all changes in status of the system and shall time-stamp such printouts with the current time-of-day and date. The printer shall be standard carriage with 80-characters per line and shall use standard pin-feed paper. The printer shall be enclosed in a separate cabinet suitable for placement on a desktop or table. The printer shall communicate with the control panel using an interface complying with Electrical Industries Association standard EIA-232D. Power to the printer shall be 120 VAC @ 60 Hz.
2. The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.
3. The system shall have a strip printer capable of being mounted directly in the main FACP enclosure. Alarms shall be printed in easy-to-read RED, other messages, such as a trouble, shall be

printed in BLACK. This printer shall receive power from the system power supply and shall operate via battery back-up if AC mains are lost. The strip printer shall be UL 864 listed.

I. Smoke Control Annunciator

1. On/Auto/Off switches and status indicators (LEDS) shall be provided for monitoring and manual control of each fan, damper, HVAC control unit, stairwell pressurization fan, and smoke exhaust fan. To ensure compliance the units supplied shall meet the following UL categories: UUKL, PAZX, UDTZ, QVAX as well as the requirements of NFPA 90A, HVAC, and NFPA 92A & 92B, Smoke Control. The control System shall be field programmable for either 90A operation or 92A/B operation to allow for future use and system expansion.
2. The OFF LED shall be Yellow, the ON LED shall be green, the Trouble/Fault LED shall be Amber/Orange for each switch. The Trouble/Fault indicator shall indicate a trouble in the control and/or monitor points associated with that switch. In addition, each group of eight switches shall have two LEDS and one momentary switch which allow the following functions: An Amber LED to indicate an OFF-NORMAL switch position, in the ON or OFF position; A Green LED to indicate ALL AUTO switch position; A Local Acknowledge/Lamp Test momentary switch.
3. Each switch shall have the capability to monitor and control two addressable inputs and two addressable outputs. In all modes, the ON and OFF indicators shall continuously follow the device status not the switch position. Positive feedback shall be employed to verify correct operation of the device being controlled. Systems that indicate on/off/auto by physical switch position only are not acceptable.
4. All HVAC switches (i.e., limit switches, vane switches, etc.) shall be provided and installed by the HVAC contractor.
5. It shall be possible to meet the requirements mentioned above utilizing wall mounted custom graphic.

2.4 GATEWAY & WEBSERVER OPTIONS

A. Common Alerting Protocol (CAP) Gateway: The system shall support an optional CAP Gateway (Common Alerting Protocol). The CAP Gateway translates fire system messages to industry standard CAP messages for integration with CAP-compliant clients. A CAP gateway shall be available from the fire alarm control panel manufacturer.

B. LEDSIGN Gateway: The system shall support an optional and proprietary LEDSIGN Gateway to interface to LED signs that will automatically display emergency messages. The signs shall be capable of storing up to 100 messages that can be activated via system programming with the ability to be manually overridden. The Sign Gateway shall support up to 10 independent signs, each sign capable of playing an independent message. Multiple LEDSIGN Gateways can be used in network applications. An LEDSIGN gateway shall be available from the fire alarm control panel manufacturer.

C. BACnet Interface Gateway: The system shall be capable of being interfaced with BACNet compliant clients. A BACnet interface supporting BACnet/IP communication shall be available from the fire alarm control panel manufacturer.

D. MODbus Interface Gateway: The system shall be capable of being interfaced with MODbus compliant clients. A MODbus interface supporting MODbus/TCP communication shall be available from the fire alarm control panel manufacturer.

E. Noti-Fire-Net Gateway: The system shall support an IP based gateway to enable the panel or local Noti-Fire-Net to be connected to an ONYXWorks workstation via the Internet or Intranet. This gateway shall also support the ability to integrate the system to an interactive firefighter's display. The Noti-Fire-Net Gateway shall be available from the fire alarm control manufacturer.

F. Webserver: The system shall support a webserver allowing remote connection via the Internet or Intranet. Authorized users will have the ability to view panel/network history, event status and device properties. The webserver shall also support sending event information via email or text to up to 50 registered users, the webserver shall be available from the fire alarm control panel manufacturer.

G. Web Portal Interface: The system shall be capable of being interfaced with a web portal to integrate with Inspection and Service Manager utilities. The web portal and inspection and service manager utilities shall be available from the fire alarm control panel manufacturer.

2.5 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices – General

1. Addressable devices shall provide an address-setting means using rotary decimal switches. Addressable devices that require the address be programmed using a programming utility are not an allowable substitute.
2. Addressable devices shall use simple to install and maintain decade, decimal address switches. Devices shall be capable of being set to an address in a range of 001 to 159.
3. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.
4. Addressable devices, which use a binary-coded address setting method, such as a DIP-switch, are not an allowable substitute. Addressable devices that require the address be programmed using a special tool or programming utility are not an allowable substitute.
5. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel Signaling Line Circuits.
6. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LEDs. Both LEDs shall flash green under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady red illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
7. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. The panel on a time-of-day basis shall automatically adjust sensitivity.
8. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72.
9. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature. Base options shall include a sounder base with a built-in (local) sounder rated at 85 DBA minimum, a relay base and an isolator base designed for Style 7 applications. The system shall also support an intelligent programmable sounder base, the programmable sounder base shall be capable of providing multiple tones based on programming and at a minimum be capable of providing a Temp-4 tone for CO (Carbon Monoxide) activation and a Temp-3 tone for fire activations and be capable of being synchronized with other programmable sounder bases and common area notification appliances; 85 DBA minimum.
10. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
11. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
12. Addressable devices shall store an internal identifying code that the control panel shall use to identify the type of device.
13. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.
14. Addressable modules shall mount in a 4-inch square (101.6 mm square), 2-1/8 inch (54 mm) deep electrical box. An optional surface mount Lexan enclosure shall be available.

B. Addressable Manual Fire Alarm Box (manual station)

1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module

status; They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.

2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.

3. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.

C. Intelligent Photoelectric Smoke Detector: The intelligent photoelectric smoke detector shall be and shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

D. Intelligent VIEW® Laser Photo Smoke Detector: The intelligent laser photo smoke detector shall be a spot type detector, that incorporates an extremely bright laser diode and an integral lens that focuses the light beam to a very small volume near a receiving photo sensor. The scattering of smoke particles shall activate the photo sensor.

1. The laser detector shall have conductive plastic so that dust accumulation is reduced significantly.

2. The intelligent laser photo detector shall have nine sensitivity levels and be sensitive to a minimum obscuration of 0.02 percent per foot.

3. The laser detector shall not require expensive conduit, special fittings or PVC pipe.

4. The intelligent laser photo detector shall support standard, relay, isolator and sounder detector bases.

5. The laser photo detector shall not require other cleaning requirements than those listed in NFPA 72. Replacement, refurbishment or specialized cleaning of the detector head shall not be required.

6. The laser photo detector shall include two bicolor LEDs that flash green in normal operation and turn on steady red in alarm.

E. Intelligent Ionization Smoke Detector: The intelligent ionization smoke detector shall use the dual-chamber ionization principal to measure products of combustion and shall, on command from the control panel, send data to the panel representing the analog level of products of combustion.

F. Intelligent Multi Criteria Acclimating Detector: The intelligent multi-criteria Acclimate® Plus™ detector shall be an addressable device, that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine its environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.

1. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).

2. The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.

G. Intelligent Thermal Detectors: The intelligent thermal detectors shall be NOTIFIER FST- series addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. A high heat thermal detector rated at 190 degrees Fahrenheit shall also be available. The thermal detectors shall connect via two wires to the fire alarm control panel signaling line circuit.

H. Intelligent Duct Smoke Detector: The smoke detector housing shall accommodate an intelligent photoelectric detector that provides continuous analog monitoring and alarm verification from the panel.

When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system. The Intelligent Duct Smoke Detector shall support the installation of addressable Photoelectric detector capable or being tested remotely. The Intelligent Duct Detector housing shall be model # DNR(W) and the remote test capable photoelectric smoke detector shall be NOTIFIER model # FSP-851R.

I. IntelliQuad™ Advanced Multi-Criteria Intelligent Detector

1. Intelligent multi-criteria fire detector shall be a NOTIFIER model number FSC-851. Smoke detector shall be an addressable intelligent multi-criteria smoke detector. The detector shall be comprised of four sensing elements, including a photoelectric (light-scattering) particulate sensor, an electrochemical carbon monoxide (CO) sensor, a daylight-filtered infrared sensor and solid state thermal sensor(s) rated at 135°F (57.2°C). The device shall be able to indicate distinct smoke and heat alarms.
2. The intelligent multi-criteria detection device shall include the ability to combine the signal of the photoelectric signal with other sensing elements in an effort to react quickly in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a nuisance alarm condition. The product design shall be capable of selecting the appropriate sensitivity levels based on the environment type chosen by user in which it is installed (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes.
3. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The device shall provide unique signals to indicate when 20% of the drift range is remaining, when 100% of drift range is used, and when there is a chamber fault to show unit requires maintenance.
4. The detector shall indicate CO trouble conditions including 6 months of sensor life remaining and sensor life has expired. The detector shall indicate a combined signal for any of the following: low chamber trouble, thermistor trouble, CO self test failure, IR self test failure, and freeze warning.
5. The detectors shall provide address-setting means on the detector head using rotary switches. Because of the possibility of installation error, systems that use binary jumpers or DIP switches to set the detector address are not acceptable. The detectors shall also store an internal identifying code that the control panel shall use to identify the type of detector. Systems that require a special programmer to set the detector address (including temporary connection at the panel) are labor intensive and not acceptable. Each detector occupies any one of at least 99 possible addresses on the signaling line circuit (SLC) loop. It responds to regular polls from the system and reports its type and status.
6. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a switch) or initiated remotely on command from the control panel. There are three test methods: functional magnet, smoke entry aerosol, or direct heat method.
7. The detectors shall provide two LEDs to provide 360° visibility. The LEDs are placed into steady red illumination by the control panel indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED, sounder base, and / or relay base (optional accessories). The external remote alarm can be interconnected to other sounder or relay bases for activating all devices in a space via a single alarming unit.
8. Two LEDs on the sensor are controlled by the panel to indicate sensor status. Coded signals, transmitted from the panel, can cause the LEDs to blink, latch on, or latch off. Refer to the control panel technical documentation for sensor LED status operation and expected delay to alarm.
9. The detectors shall be ceiling-mount and shall be plug-in mounted into a twist-lock base. These detectors shall be constructed of off-white UV resistant polymer and shall be detachable from the mounting base to simplify installation, service and maintenance. Mounting base wiring connections shall be made by means of SEMS screws. The detector shall allow pre-wiring of the base and the head shall be a plug-in type. Mounting base shall be mounted on junction box which

is at least 1.5 inches (3.81 cm) deep. Mounting base shall be available to mount to standard junction boxes. Suitable boxes include:

a. 4.0" (10.16 cm) square box with and without plaster ring.
b. 4.0" (10.16 cm) octagonal box.
c. 3.5" (8.89 cm) octagonal box.
d. Single-gang box.

10. Meets Agency Standards

a. ANSI/UL 268 -Smoke Detectors for Fire Alarm Signaling Systems
b. CAN/ULC-S529- Smoke Detectors for Fire Alarm Systems
c. FM 3230-3250- Smoke Actuated Detectors for Automatic Fire Alarm Signaling

J. IntelliQuad™ PLUS Advanced Multi-Criteria Intelligent Fire/CO Detector

1. Advanced Multi-Criteria Fire/CO detector shall be NOTIFIER model # FCO-851 and shall be an addressable advanced multi-criteria smoke detector with a separate signal for carbon monoxide (CO) detection per UL 2075 standards.
2. The detector shall be comprised of four sensing elements, including a photoelectric (light-scattering) particulate sensor, an electrochemical CO sensor, a daylight-filtered infrared (IR) sensor and solid state thermal sensor(s) rated at 135°F (57.2°C). The device shall be able to indicate distinct smoke and heat alarms.
3. The advanced multi-criteria detection device shall include the ability to combine the signal of the photoelectric signal with other sensing elements in order to react quickly in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a nuisance alarm condition. The detector shall be capable of selecting the appropriate sensitivity levels based on the environment type (office, manufacturing, kitchen, etc.) in which it is installed, and then have the ability to automatically change the setting as the environment changes.
4. The CO detector component shall be capable of a functional gas test using a canned test agent to test the functionality of the CO sensing cell.
5. The detector shall be capable of automatically adjusting its sensitivity by means of drift compensation and smoothing algorithms. The device shall provide unique signals to indicate when 20 percent of the drift range is remaining, when 100 percent of drift range is used, and when there is a chamber fault to show the unit requires maintenance.
6. The detector shall indicate CO trouble conditions, including six months of sensor life remaining and sensor life has expired. The detector shall indicate a combined signal for any of the following: low chamber trouble, thermistor trouble, CO self test failure, IR self test failure, and freeze warning.
7. The detector shall provide address-setting means on the detector head using rotary switches. Because of the possibility of installation error, systems that use binary jumpers or DIP switches to set the detector address are not acceptable. The detector shall also store an internal identifying code that the control panel shall use to identify the type of detector. Systems that require a special programmer to set the detector address (including temporary connection at the panel) are labor intensive and not acceptable. Each detector occupies any one of at least 159 possible addresses on the signaling line circuit (SLC) loop. It responds to regular polls from the system and reports its type and status.
8. The detector shall provide a test means whereby it will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a switch) or initiated remotely on command from the control panel. There shall be four test methods: functional magnet, smoke entry aerosol, carbon monoxide aerosol or direct heat method.
9. The detector shall provide two LEDs to provide 360° visibility. The LEDs shall be placed into steady red illumination by the control panel indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED. The detector must be capable of connecting to a sounder base that provides both temporal 3 and temporal 4 patterns for fire and CO alarm.
10. Two LEDs on the sensor shall be controlled by the panel to indicate sensor status. Coded signals, transmitted from the panel, shall cause the LEDs to blink, latch on, or latch off. Refer to the

control panel technical documentation for sensor LED status operation and expected delay to alarm.

11. The detector shall be plug-in mounted into a twist-lock base. The detector shall be constructed of off-white, UV-resistant polymer and shall be detachable from the mounting base to simplify installation, service and maintenance. Mounting base wiring connections shall be made by means of SEMS screws. The detector shall allow pre-wiring of the base and the head shall be a plug-in type. The mounting base shall be mounted on a junction box that is at least 1.5 inches (3.81 cm) deep. The mounting base shall be available to mount to standard junction boxes. Suitable boxes include:

a. 4.0" (10.16 cm) square box with and without plaster ring.
b. 4.0" (10.16 cm) octagonal box.
c. 3.5" (8.89 cm) octagonal box.
d. Single-gang box.
e. Double-gang box

12. Meets Agency Standards

a. ANSI/UL 268 -Smoke Detectors for Fire Alarm Signaling Systems
b. CAN/ULC-S529- Smoke Detectors for Fire Alarm Systems
c. FM 3230-3250- Smoke Actuated Detectors for Automatic Fire Alarm Signaling
d. UL 2075 – Gas and Vapor Detector and Sensors – Systems Connected

K. Intelligent Addressable Aspiration Detector: The intelligent aspiration detector shall be NOTIFIER model # FSA-8000 an addressable aspiration detector that communicates directly with the fire alarm control panel via the SLC communication protocol, no modules or high level interfaces shall be required. The fire alarm control panel shall support up to thirty one intelligent aspiration detectors per SLC loop. The aspiration detector shall have dual source (blue LED and infra-red laser) optical smoke detection for a wide range of fire detection with enhanced immunity to nuisance particulates. The FACP shall be capable of monitoring and annunciating up to five smoke event thresholds and eleven trouble conditions. Each event threshold shall be capable of being assigned a discrete type ID at the FACP.

L. Intelligent Addressable Reflected Beam Detector

1. The intelligent single-ended reflected beam smoke detector shall connect with two wires to the fire alarm control panel signaling line circuit (SLC). The detectors shall consist of a transmitter/receiver unit and a reflector and shall send data to the panel representing the analog level of smoke density. The detector shall be capable of being tested remotely via a keyswitch; NOTIFIER model # FSB-200. Model # FSB-200S shall be equipped with an integral sensitivity test feature.

M. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs. The addressable monitor module shall be NOTIFIER model # FMM-1 (Class A or B) or FMM-101 (Class B)
2. The IDC zone shall be suitable for Style D/Class A or Style B/Class B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.
4. For multiple dry contact monitoring a module shall be available that provides 10 Style B or 5 Style D input circuits; NOTIFIER model # XP10-M.

N. Two Wire Detector Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional 2-wire smoke detectors or alarm initiating devices (any N.O. dry contact device);

NOTIFIER model # FZM-1.
2. The IDC zone may be wired for Class A or B (Style D or Style B) operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
3. For multiple 2-wire smoke detector circuit monitoring a module shall be available that provides 6 Style B/Class A or 3 Style D/Class B input circuits; NOTIFIER model # XP6-MA.

O. Addressable Control Module

1. Addressable control modules shall be provided to supervise and control the operation of one conventional circuit of compatible Notification Appliances, 24 VDC powered, polarized audio/visual notification appliances; NOTIFIER model # FCM-1
2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with a current rating of 2 Amps for Style Z and 3 Amps for Style Y;
3. Audio/visual power shall be provided by a separate supervised circuit from the main fire alarm control panel or from a supervised UL listed remote supply.
4. For multiple circuit control a module shall be available that provides 6 Style Y (Class B) or 3 Style Z (Class A) control circuits; NOTIFIER model # XP6-C.

P. Addressable Releasing Control Module

1. An addressable FlashScan releasing module shall be available to supervise and control compatible releasing agent solenoids; NOTIFIER model # FCM-1-REL.
2. The module shall operate on a redundant protocol for added protection.
3. The module shall be configurable for Style Z or Style Y (Class A/B) and support one 24 volt or two 12 volt solenoids.Add FMM-4-20

Q. Addressable 4-20 mA module shall be available to monitor industry-standard, linear-scale, 4-20 mA protocol sensors. The module converts the sensor output to communication protocol that can be interpreted by the FACP for monitoring and display; NOTIFIER model # FMM-4-20.

1. The module shall support programming of up to five programmable event thresholds.
2. The System shall be FM 6320 (Factory Mutual) approved as a Gas Detection system when employed with the FMM-4-20 monitor module and industry standard 4-20 mA gas detectors.

R. Addressable Relay Module:

1. Addressable Relay Modules shall be available for HVAC control and other network building functions; NOTIFIER model # FRM-1.
2. The module shall provide two form C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.
3. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary devices energize at the same time on the same pair of wires;
20 4. For multiple relay control a module shall be available that provides 6 programmable Form-C relays; NOTIFIER model # XP6-R.

S. Addressable Two-In / Two-Out Monitor/Relay Module:

1. An addressable Two-In / Two-Out module shall be available; NOTIFIER model # FDRM-1.
2. The two-in/two-out module shall provide two Class B/Style B dry-contact input circuits and two independent Form-C relays rated at up to 3 Amps resistive and up to 2.0 Amps inductive.

T. Isolator Module: Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building; NOTIFIER model # ISO-X.

1. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit

(disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.

2. The isolator module shall not require address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.

3. The isolator module shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.

U. Serially Connected Annunciator Requirements

1. The annunciator shall communicate to the fire alarm control panel via an EIA 485 (multi-drop) two-wire communications loop. The system shall support two 6,000 ft. EIA-485 wire runs. Up to 32 annunciators, each configured up to 96 points, may be connected to the connection, for a system capacity of 3,072 points of annunciation.

2. An EIA-485 repeater shall be available to extend the EIA-485 wire distance in 3,000 ft. increments. The repeater shall be UL864 approved.

3. Each annunciator shall provide up to 96 alarm and 97 trouble indications using a long-life programmable color LED's. Up to 96 control switches shall also be available for the control of Fire Alarm Control Panel functions. The annunciator will also have an "ON-LINE" LED, local piezo sounder, local acknowledge and lamp test switch, and custom zone/function identification labels.

4. The annunciator may be field configured to operate as a "Fan Control Annunciator". When configured as "Fan Control," the annunciator may be used to manually control fan or damper operation and can be set to override automatic commands to all fans/dampers programmed to the annunciator.

5. Annunciator switches may be programmed for System control such as, Global Acknowledge, Global Signal Silence, Global System Reset, and on/off control of any control point in the system.

6. An optional module shall be available to utilize annunciator points to drive EIA-485 driven relays. This shall extend the system point capacity by 3,072 remote contacts.

7. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.

V. SpectrAlert Advance Speakers

1. The Speaker appliance shall be System Sensor SpectrAlert Advance model _____ Speaker. The speaker shall be listed to UL 1480 for Fire Protective Signaling Systems. It shall be a dual-voltage transformer speaker capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.

2. A universal mounting plate shall be used for mounting ceiling and wall speaker products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate.

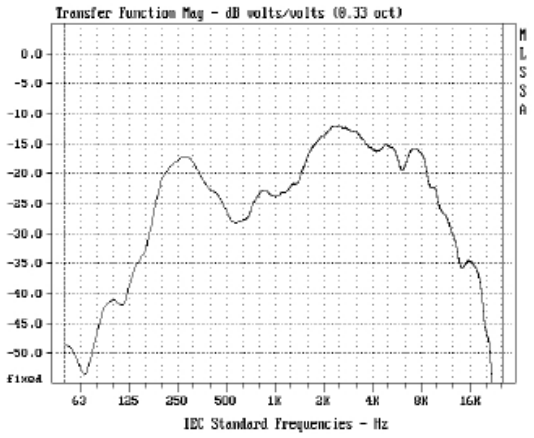
3. Speakers shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker design shall isolate speaker components to reduce ground fault incidents.

4. The speaker shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction.

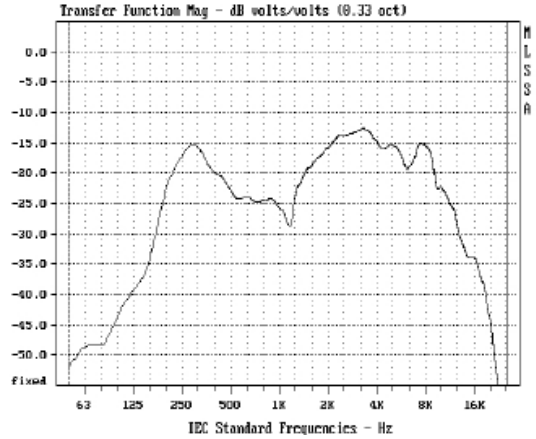
5. All notification appliances shall be backward compatible.

Ceiling Speaker Wall Speaker

Wide Band Frequency Response



Wide Band Frequency Response

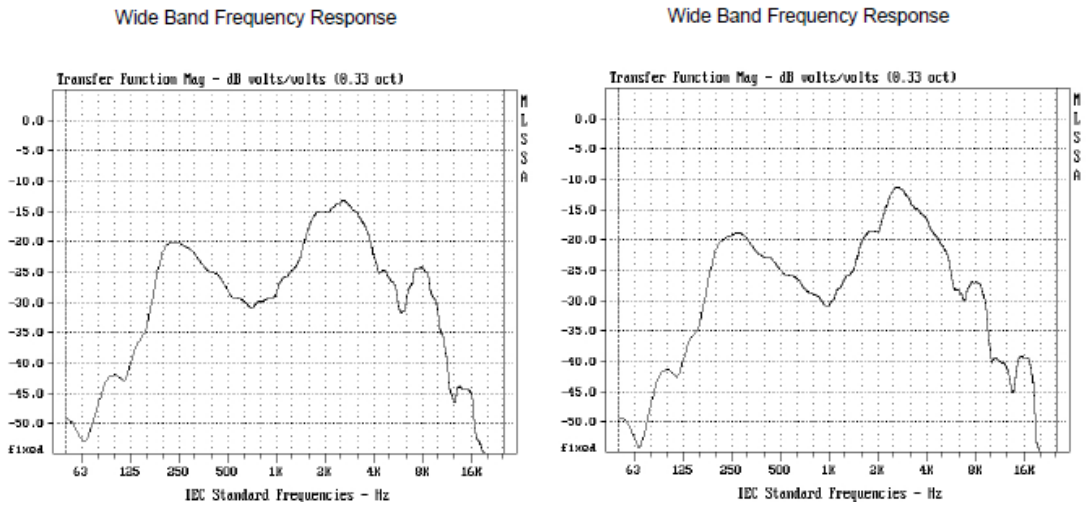


Note: The wide band frequency response is derived using MLS methods

W. SpectrAlert Advance Speaker Strobes

1. The Speaker Strobe appliance shall be System Sensor SpectrAlert Advance SPS and SPV series Speaker Strobe. The speaker strobe shall be listed to UL 1971 and UL 1480 and be approved for fire protective signaling systems. It shall be a dual-voltage transformer speaker strobe capable of operation at 25.0 or 70.7 nominal Vrms. The speaker shall have a frequency range of 400 to 4,000 Hz and shall have an operating temperature between 32°F and 120°F. It shall mount to a 4 x 4 x 2 1/8-inch back box.
2. A universal mounting plate shall be used for mounting ceiling and wall speaker strobe products. The notification appliance circuit and amplifier wiring shall terminate at the universal mounting plate. Also, SpectrAlert Advance speaker strobes and the Sync•Circuit™ Module MDL3 accessory, if used, shall be powered from a non-coded notification appliance circuit output and shall operate on a nominal 12 or 24 volts (includes fire alarm panels with built in sync). When used with the Sync•Circuit Module MDL3, 12-volt rated notification appliance circuit outputs shall operate between 8.5 and 17.5 volts; 24-volt rated notification appliance circuit outputs shall operate between 16.5 to 33 volts. If the notification appliances are not UL 9th edition listed with the corresponding panel or power supply being used, then refer to the compatibility listing of the panel to determine maximum devices on a circuit.
3. Speaker strobes shall be plug-in and shall have the ability to check wiring continuity via a shorting spring on the universal mounting plate. The shorting spring shall also provide tamper resistance via an open circuit if the device is removed. Speaker strobe design shall isolate speaker components to reduce ground fault incidents.
4. The speaker strobe shall have power taps (from ¼ watt to 2 watts) and voltage that are selected by rotary switches. All models shall have a maximum sound output of 86 dB at 10 feet and shall incorporate an open back construction. The strobe shall consist of a xenon flash tube with associated lens/reflector system and operate on either 12V or 24V. The strobe shall also feature selectable candela output, providing options for 15 or 15/75 candela when operating on 12V and 15, 15/75, 30, 75, 110, or 115 when operating on 24V. The strobe shall comply with NFPA 72 and the Americans with Disabilities Act requirement for visible signaling appliances, flashing at 1 Hz over the strobe's entire operating voltage range.
5. All notification appliances shall be backward compatible.

Ceiling Speaker Strobe Wall Speaker Strobe



Note: The wide band frequency response is derived using MLS methods

6. Strobe lights shall meet the requirements of the ADA, UL Standard 1971and be fully synchronized.

X. FIRE ALARM CABLE

1 The fire alarm cable shall plenum rated and be UL listed and suitable for use as power limited fire protective signaling circuit cable in accordance with National Electric Code Article 760 (Fire Alarm Systems) and Article 725 (Class 1, Class 2 and Class 3 - Remote Control, Signaling and Power-Limited Circuits).

A. Cable Construction

1 Conductors shall be solid, soft annealed, uncoated copper.

2 Insulation shall be 300 volt, 105ºC polyvinylchloride.

3 Two conductor, non-shielded cables shall be parallel; shielded and three or more conductors shall be cabled round.

4 Shielding shall be mylar backed aluminum foil, helically wrapped to provide 100% coverage. A suitable copper drain wire shall be provided with shielded cables.

5 Jacket shall be red, 105ºC polyvinylchloride, rated 300 volt.

6 Cable shall be plenum rated when installed in air handling plenums.

B. In general, non-shielded cable is acceptable for use throughout except on voice circuits. All voice circuits shall utilize shielded, twisted pair cable.

PART 3.0 - EXECUTION

3.1. INSTALLATION:

A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.

B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.

C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

D. Manual fire alarm boxes shall be suitable for surface mounting or semi-flush mounting as shown on the plans, and shall be installed not less than 42 inches (1067 mm), nor more than 48 inches (122 mm) above the finished floor.

3.2. TEST:

The service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment shall be provided to technically supervise and participate during all of the adjustments and tests for the system. All testing shall be in accordance with NFPA 72.

A. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.

B. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.

C. Verify activation of all waterflow switches.

D. Open initiating device circuits and verify that the trouble signal actuates.

E. Open and short signaling line circuits and verify that the trouble signal actuates.

F. Open and short notification appliance circuits and verify that trouble signal actuates.

G. Ground all circuits and verify response of trouble signals.

H. Check presence and audibility of tone at all alarm notification devices.

I. Check installation, supervision, and operation of all intelligent smoke detectors using the walk test.

J. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.

K. When the system is equipped with optional features, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.3. FINAL INSPECTION:

A. At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the system functions properly in every respect.

3.4. INSTRUCTION:

A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.

B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

END OF SECTION

SECTION 02100 - SITE PREPARATION

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Demolition of existing site elements per Demolition Plan and/or as required for installation of new work.
B. Clearing of site.

1.02 RELATED SECTIONS:

A. Temporary erosion and sediment control during construction - Section 02150.
B. Earthwork - Section 02200 or Section 02202 and/or Section 02222

1.03 NOTIFICATION TO OWNERS OF UTILITY LINES AND EQUIPMENT:

A. Notify any corporation, company, individual or local authority owning conduits, wires, pipes or equipment on site that is affected by work.
B. Arrange for removal or relocation of indicated items and pay any fees or costs in conjunction with removal or relocation, except as otherwise noted.
C. Cap lines in accordance with instructions of governing authorities or Owners.

1.04 PROTECTIONS:

A. Protect trees, plants and other landscape features designated to remain.

1.05 EXPLOSIVES:

A. Use of explosives is strictly prohibited.

PART 2 - PRODUCTS - NONE IN THIS SECTION

PART 3 - EXECUTION

3.01 PREPARATION:

A. Verify that abandoned utilities have been properly disconnected and capped.
B. Verify that barricades and other protective measures are in place.

3.02 CLEARING:

A. Remove existing scrub trees and shrubs, including root systems.

B. Strip and clear building areas, or areas requiring cutting or filling, free of vegetation. Leave construction areas clean, free of vegetation and debris, and ready for earthwork.
C. Remove debris and trash from site.

END OF SECTION

SECTION 02102-CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 GENERAL DESCRIPTION OF WORK

A. Cleaning and grubbing shall consist of the removal of trees, stumps, brush, roots, vegetation, logs, rubbish, and other objectionable matter within the project site limits described in the specifications or as shown on plans.

B. Cleaning and grubbing shall be done in advance of grading operation. Grubbing may be done simultaneously with excavation, if the cuts are over 3 feet in depth and objectionable matter is removed as specified.

C. Clearing and Grubbing shall consist of the disposal of all debris resulting from the work specified herein.

1.02 PROTECTION OF ADJACENT WORK:

A. Provide protection necessary to prevent injury or damage to existing improvements, adjacent property, utilities and other facilities, and trees and plants, indicated to remain in place.

B. Protect improvements on adjoining properties and all areas outside indicated construction areas from injury or damage.

C. Restore damaged improvements to their original condition, as acceptable to the Engineer and property owners.

D. Conduct site clearing and grubbing operations to ensure minimum interference with road, streets, walks, and other adjacent, occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Provide all required personnel, equipment, and materials required to perform the work as specified.

PART 3 - EXECUTION

3.01 CLEARING:

A. Clear all areas covered by dikes, roads, structures and embankments within project limits unless otherwise shown in plans.

B. Remove all saplings, brush, down-timber and debris unless shown or directed otherwise.

C. Use tree wound paint to treat scars, gashes or limbs stubs on trees not removed.

3.02 GRUBBING:

A. Trees, stumps, root systems, rocks and other obstructions shall be removed to the depths shown when they fall within the construction templates for the following items:

1.	Footings	18-inches below bottom of footing.
2.	Sidewalks (or other types of walks)	12-inches below bottom of walk.
3.	Roadways or Streets	24-inches below bottom of base material.
4.	Parking Areas	24-inches below bottom of base material.
5.	Grassed Areas	18-inches below top soil.
6.	Fills	24-inches below bottom of fill.

B. Blasting not permitted.

3.03 REMOVAL OF DEBRIS AND CLEANUP

A. Burn as permitted by regulating agencies or the Engineer as work progresses.

B. Unguarded fires will not be permitted.

C. Permits will be obtained, where required, for necessary burning or disposal sites.

D. Dispose of all waste materials not burned by removal from site.

E. Materials cleared and grubbed shall be the property of the Contractor and shall be his responsibility for disposal.

PART 4 - MEASUREMENT AND PAYMENT

4.01 CLEARING AND GRUBBING:

A. Clearing and Grubbing shall be measured for payment either in acres or by lump sum only for areas indicated on the plans, or as provided in the proposal and contract.

B. When not listed as separate contract pay item, Clearing and Grubbing shall be considered as incidental work, and the cost thereof shall be included in such contract pay items as are provided in the proposal contract.

C. Compensation, whether by contract pay item or incidental work will be for furnishing all materials, labor equipment, tools and in incidentals required for the work, all in accordance with the plans

and these specifications.

END OF SECTION

SECTION 02150

TEMPORARY EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Temporary measures required to control erosion and sediment during construction. This includes measures to meet the requirements of the National Pollution Discharge Elimination System (NPDES) administered by the Environmental Protection Agency (EPA).

B. Temporary hay bale dike.

C. Stabilized construction entrance.

D. Silt fence.

E. Rock check dam.

F. Sediment basin with stone and pipe outlet

G. Diversion dike.

H. Storm Water Pollution Prevention Plan (SWP3).

1.02 RELATED SECTIONS:

A. Grass seeding for slope protection and erosion control - Section 02270.

B. Site Preparation - Section 02100.

C. Earthwork - Section 02200 or Section 02202 and/or 02222

1.03 REFERENCES:

A. ASTM D3786 - Hydraulic Bursting Strength of Knitted Goods and Non-woven Fabrics. (Mullen Burst)

B. ASTM D3787 - Bursting Strength of Knitted Goods; Constant Rate of Traverse (CRT) Ball Burst Test

C. ASTM D4355 - Deterioration of Geotextiles From Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).

D. ASTM D4491 - Water Permeability of Geotextiles by Perrnittivity.

E. ASTM D4533 - Index Trapezoidal Tearing Strength of Geotextiles.F. ASTM D4632 Grab Breaking Load and Elongation of Geotextiles. (Tensile Strength).

F. ASTM D4751 - Determining the Apparent Opening Size of a Geotextile.

H. ASTM Al 16, - Zinc Coated (Galvanized) Steel Woven Wire Fence Fabric.

I. ASTM D698 - Test for Moisture Density Relations for Soils (Standard).

J. Texas Department of Transportation (TXDOT) 1993 Standard Specifications for Construction of Highways, Streets, and Bridges. Measurement and payment sections do not apply. Item 432 - Rip Rap.

1.04 SUBMITTALS:

A. Procedures for Submittals: Section 01300.

B. Product Data:
1. Sift fencing.
2. Non-woven filter fabric.
3. Erosion control and revegetation mat

C. Prepare and submit a Storm Water Pollution Prevention Plan (SWP3).

D. Inspection Reports and Certificates:
1. Submit period inspection reports and certificates required for SWP3.
2. Submit Contractor/Subcontractor certifications required for SWP3.

E. Submit revisions or modifications to the erosion and sediment control plan and SWP3.

1.05 MAINTENANCE:

A. Maintain erosion control devices as necessary to comply with NPDES. This includes any revisions or modifications to the plan. Any work required for modifications, revisions and maintenance shall be the responsibility of the Contractor and shall -not be a basis for additional compensation.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Hay bales, if used, shall weigh a minimum of (50) pounds and shall be at least thirty (30) inches in length. Bales shall be composed entirely of vegetable matter and be free of seeds. Binding shall be either wire or nylon string, jute or cotton binding is unacceptable. Bales shall be used for not more than two months before being replaced. However, if weather conditions cause biological degradation of the hay bales, they shall be replaced sooner than the two month time period to prevent a loss of structural integrity of the hay bale dike.

B. Stone material at all drainage structures shall consist of stone rip-rap conforming to TXDOT Standard Specification Item 432 and shall have gradation and be placed as shown on the plans and in a layer of at least 24 inches thick. Stone material for rock check dams shall consist of only well graded crushed rock, 4-8 inches in diameter, and shall be placed as detailed on plans. Stone material for stabilized construction exit shall consist of 3" to 5" crushed rock mixed with Type “A”" Flexbase to create a drivable surface and shall be placed as shown on the plans.

C. Geotextile Fabrics shall be a non-woven polypropylene fabric designed specifically. for use as a soil filtration media. Fabric shall have an approximate weight of 8 oztyd,2.

D. Geotextile Silt Fence Fabric shall be a nylon reinforced polypropylene woven fabric having a reinforcing cord running the entire length to the top edge of the fabric.

Representative Manufacturer Mirafi, Inc. sift fence, Amoco (2130) or owner approved equal.

E. Fence Posts for Sift Fence of sufficient length and strength to support the silt fence system.

PART 3 - EXECUTION

3.01 EXAMINATION AND PREPARATION:

A. Submit SWP3 and the erosion and sediment control plan and modify as required for the Contractor's construction sequence. Modifications shall maintain conformance with the Contractor's storm water pollution prevention plan and the requirements of NPDES. Work and materials required for installation, modification and maintenance of the Erosion Control System shall be incidental to the contract.

B. Locate and protect survey horizontal and vertical control.

3.02 TEMPORARY HAY BALE DIKE:

A. Install where shown on the plans or as needed for erosion control.

B. Hay bales shall be embedded a minimum of four (4) inches and securely anchored using 3/8. inch diameter steel stakes or 2" x 2" wood stakes driven through the bales into the ground a minimum of six (6) inches. Hay bales are to be placed end to end directly adjacent to one another leaving no gap between them.

C. Hay bale dikes are to be used in locations receiving overland sheet flow only.

3.03 STABILIZED CONSTRUCTION EXIT

A. A temporary construction exit shall be installed at any point where traffic will be leaving the construction site to a public right-of-way, street, alley, sidewalk or parking area. The purpose of a stabilized construction exit is to reduce or eliminate the tracking or flowing of sediment onto public rights-of-way. The exit must be properly graded or incorporate a drainage swale to prevent runoff from leaving the construction site. The length of the exit shall be as required, but not less than 100 feet and the width shall be at least 20 feet. The stabilized exit shall be constructed of rock as described in 2.1.B. and shall be completely underlined with geotextile filter fabric described in 2.1.C, Value 1.

B. The temporary construction exit shall be maintained in a condition which will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic top dressing with additional stone as conditions demand and repair and/or clean out of any measures used to trap sediment. All sediment spilled, dropped, washed or tracked onto public rights-of-way must be removed immediately by the Contractor.

C. When necessary, wheels must be washed or brushed to remove sediment prior to entrance onto public right-of-way. When washing is required, it shall be done on an area stabilized with crushed stone which drains into an approved sediment trap or sediment basin. All sediment shall be prevented from entering any storm drain, ditch or watercourse using approved methods.

3.04 SILT FENCE:

A. Silt Fence: Shall consist of nylon reinforced polypropylene woven fabric supported by posts set a minimum depth of 18 inches and spaced not more than 6 feet on center. A 6-inch wide trench is to be cut 6 inches deep at the toe of the fence on the uphill side to allow the fabric to be laid below the surface and back filled with gravel. Fabric shall have a 6-inch, double overlap securely fastened at a post at abutting ends, and shall be joined such that no leakage or bypass occurs. Remove accumulated sediment when the depth of sediment reaches 6 inches.

3.05 ROCK CHECK DAM:

A. Rock Check Dams shall be constructed at locations shown on the plans and in swales as needed to reduce velocity in swales. Geotextile fabric as described in 2.1.C., Value I shall be placed beneath the rock and shall conform to these specifications. Rock shall conform to these specifications.

3.06 DIVERSION DIKE:

A. Diversion dikes, if used by the Contractor, shall be installed prior to and maintained for the duration of construction and shall intercept no more than five (5) acres of runoff. Dikes shall have a minimum top width of 2'-0" and a minimum height Of Compacted fill of 18" measured from the top of the existing ground at the upslope toe to top of the dike and having side slopes of 3:1 or flatter. The channel which is formed by the dike must have a minimum slope of one (1) percent for the entire length to an outlet. When the

slope exceeds three (3) percent, or velocities exceed one foot per second (regardless of slope), stone stabilization (Type "Am rip-rap) is required. Plant grass on dikes not requiring stone stabilization.

3.07 STORM WATER POLLUTION PREVENTION PLAN (SWP3):

A. The Contractor is required to prepare the SWP3 required for this project.

3.08 NOTICE OF INTENT (NOI), NOTICE OF TERMINATION (NOT):

A. Contractor shall submit a Notice of Intent (NOI) at least 48 hours prior to the start of construction.

B. Contractor shall submit a Notice of Termination (NOT) as required by the NPDES regulations.

3.09 At the close of this contract the Contractor shall remove the temporary erosion control devices when permanent facilities are in place.

END OF SECTION

SECTION 02202 – EARTHWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Clearing and Grubbing as required in order to perform earthwork as shown within contract drawings.

B. Stripping 6" of existing topsoil, stockpiling on-site and re-spreading topsoil as directed by Owner's Representative

D. Excavation and Fills to grades represented within drawings.

E. Compaction of Embankments and Fills to specified densities.

F. Definitions:
"Excavation" consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.

"Density" is referred to as a percentage of the ASTM D698. Standard Proctor Density

1.03 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Testing and Inspection Service: At Contractor's expense, testing laboratory to perform soil testing and inspection service for quality control testing during earthwork operations. Testing laboratory to be selected by Owner.

1.04 SUBMITTALS

A. Test Reports: Submit following reports directly to Owner's Representative from the testing laboratory with a copy to the Owner.

1. Test reports on borrow material (as applicable)

2. Field density test reports.

3. One optimum moisture-maximum density curve for each type of soil encountered.
4. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

B. Site Information: Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil bearings. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn therefrom by Contractor. Data is made available for convenience of Contractor.

1. Additional test borings and other exploratory operations may be made by Contractor at no cost to Owner.

C. Existing Utilities: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult Utility Owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of Utility Owner.

2. Do not interrupt existing utilities serving facilities occupied and used by Owner or others during occupied hours except when permitted in writing by Owner or Owner's Representative and then only after acceptable temporary utility services have been provided.

   Provide a minimum of forty eight (48) hour notice to Owner and receive written notice to proceed before interrupting any utility.

3. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.

D. Use of Explosives: The use of explosives is not permitted.

E. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as recommended by authorities having jurisdiction.

2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

3. Perform excavations within drip line of large trees to remain by hand and protect root system from damage or dryout to the greatest extent possible.

Maintain moist condition for root system and cover exposed roots with burlap. Paint root cuts of 1" diameter and larger with emulsified asphalt tree paint.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Definitions:

1. Satisfactory soil materials: are those complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, and SP.

2. Select Backfill : Satisfactory soil materials free of clay, rock, or gravel larger than 2" in any dimension, debris, waste, frozen materials, and other deleterious matter and having a PI < 25.

PART 3 - EXECUTION

3.01 EXCAVATION

A. Excavation is Unclassified and includes excavation to subgrade elevations indicated regardless of character of materials and obstruction encountered.

B. Unauthorized Excavation:

1. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Owner's Representative. Unauthorized excavation, as well as remedial work directed by the Owner's Representative, shall be at Contractor's expense.

2. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to Owner's Representative.

3. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavation of same classification, unless otherwise directed by Owner's Representative.

D. Additional Excavation:

1. When excavation has reached required subgrade elevations, notify the Owner's Representative who will make an inspection of conditions.

2. If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by Owner's Representative.

3. Removal of unsuitable material and its replacement as directed will be paid per contract cost.

4. Stability of Excavations:

   A. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

   B. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

E. Trench Safety Systems:

A trench shoring safety plan shall be required complying with latest OSHA standards for all trench excavations exceeding 5' in depth.

F. Temporary Drainage / Dewatering:

1. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding property.

2. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well pints, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavation.

3. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavation to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

G. Material Storage:

1. Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.

2. Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

3. Dispose of excess soil material at locations on site as directed by Owner's Representative.

H. Cold Weather Protection: Protect excavation bottoms against freezing when atmosphere temperature is less than 35° F. (1° C.).

3.02 COMPACTION

A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.

B. Percentage of Density Requirements:

1. Structures, Building Slabs and Steps: in accordance with Structural Drawings. (as applicable)

2. Roadways, parking areas, sidewalks or tracks: Compact subgrade and each layer of backfill or fill material at 95% standard Proctor ASTM D-698-91 at a moisture content of no more than 3% above optimum moisture for cohesive material or 95% maximum density for cohesionless material.

3. Open areas, landscapes, sport fields: Compact subgrade and each layer of backfill or fill material at 90% standard Proctor ASTM D-698-91 at a moisture content of no more than 3% above optimum moisture for cohesive material or 90% maximum density for cohesionless material.

C. Moisture Control:

1. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material to prevent free water appearing on surface during or subsequent to compaction operations.

2. Remove and replace or scarify and air dry soil material that is too wet to permit compaction to specified density.

3. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying

by discing, harrowing, or pulverizing until moisture contact is reduced to a satisfactory value.

3.03 BACKFILL AND FILL

A. Under grassed or open areas: Onsite excavated or borrow material free of: clay, rock or gravel larger than 2" in any dimension, site debris, frozen material and deleterious matter and vegetation.

B. Under roadway, parking and sidewalk: Select backfill. In the event the excavated material or "cuts" do not meet the requirements of select backfill, Engineer shall determine suitability of onsite excavated material. Additional borrow material as required shall be paid for by owner.

C. Under Buildings: (See Structural Drawings as applicable)

D. Ground Surface Preparation:

1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

2. When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture condition to optimum moisture content, and compact to required depth and percentage of maximum density.

E. Placement and Compaction:

1. Place backfill and fill materials in layers not more than 8" in loose depth for material compacted by heavy compaction equipment, and not more than 4" in loose depth for material compacted by hand operated tampers.

2. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture contact. Compact each layer to required percentage of maximum density. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

3. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping or conduit to approximately same elevation in each lift.

3.04 GRADING

A. General:

1. Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within 0.10' above or below required subgrade elevation.

2. Grade areas to prevent ponding

3.05 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Allow and coordinate with testing service to inspect and approve subgrades and fill layers before further construction work is performed.

1. Roadways, Parking Areas and Building Slab Subgrade: In each compacted fill layer, make at least one (1) field density test of subgrade for every 50,000 sq. ft. of paved area or building slab, but in no case less than three (3) tests.

2. All other areas: In each compacted fill layer, make at least one (1) field density test for every 75,000 sq. ft. of fill area, but in no case less than two (2) tests.

3. In the event any field density test fail, subsequent density test within this area on this compacted fill layer shall be at the expense of the Contractor.

If in the opinion of the Owner's Representative based on testing labratory reports or inspection, subgrade or fills which have been placed that do not meet the requirements of this specification, Contractor shall provide additional compaction and testing at his expense.

3.06 MAINTENANCE

A. Protection of Graded Areas:

1. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

2. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

C. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact and replace surface treatment. Restore

appearance, quality, and condition of surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.07 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of it off Owner's property.

END OF SECTION

SECTION 02230-EXCAVATION

PART I - GENERAL

1.01 GENERAL DESCRIPTION OF WORK

A. This work shall consist of excavating and properly utilizing, or otherwise satisfactorily disposing of, all excavated materials, of whatever character, within the limits of work.

B. Excavation shall also consist of constructing, compacting, shaping and finishing of all earthwork in designated areas on the plans, as specified herein, and in conformity with the required line grades and typical cross sections or as directed by the Engineer.

C. When not otherwise included, this items shall include the work described in Section 2101 - Preparation of Right of Way, Section 2102 - Clearing and Grubbing, Section 2236 - Embankment, Section 2238 - Removal of Concrete, and Section 2210 - Subgrade Preparation.

PART II - PRODUCTS

2.01 CLASSIFICATION

A. All excavations shall be unclassified and shall include all materials encountered regardless of their nature or the manner in which they are removed.

PART III - EXECUTION

3.01 CONSTRUCTION METHODS

A. Prior to commencing this work, all erosion control and tree protection measures required shall be in place and all utilities located and protected.

B. Construction equipment shall not be operated within the drip line of trees, unless otherwise indicted.

C. Construction materials shall not be stockpiles under the canopies of trees. No excavation or embankment shall be placed within the drip line of trees until tree wells are constructed.

D. All excavation shall be performed as specified herein and shall conform to the established alignment, grades and cross sections.

E. Suitable excavated materials shall be utilized, insofar as practical, in constructing required embankments.

F. The construction of all embankments shall conform to Section 2236 - Embankment. No material shall be stockpiled within the banks of a waterway.

G. Unsuitable excavated materials or excavation in excess of that needed for construction shall be known as "Waste" and shall become the property of the Contractor. It shall become his sole responsibility to dispose of this material off the limits of the right of way in an environmentally sound manner at a permitted disposal site.

H. Adequate dewatering and drainage of excavation shall be maintained throughout the time required to complete the work.

PART IV - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

A. Measurement of the volume of excavation in cubic yards by the average end areas. Cross sectional areas shall be computed from existing ground section to the established line of the subgrade, as shown on typical sections for the limits of the right-of-way or other work limits, including parkway slopes and sidewalk areas.

B. Measurement of the area in square yards of surface area excavated as shown on the typical sections included in the plans.

C. Measurement of the volume of excavation is in cubic yards, based upon the average end areas taken from pre-construction cross sections and planned grades. The planned quantities for excavation will be used as the measurement for payment for this item.

4.02 PAYMENT:

A. This item will be paid for at the contract unit price bid for "Excavation," as provided under the measurement method as included in the bid, which price shall be full compensation for all work herein specified: including dewatering, drainage, subgrade preparation, unless otherwise indicated and the furnishing of all materials, equipment, tools, labor and incidentals necessary to complete the work.

B. When not listed as a separate contract pay item, excavation shall be considered as incidental work, and the cost thereof shall be included in such contract pay item(s) as are provided in the proposal contract.

C. Compensation, whether by contract pay item or incidental work will be for furnishing all materials, labor, equipment, tools and incidentals required for the work, all in accordance with the plans and these specifications.

END OF SECTION

SECTION 02251 – HOT MIX ASPHALTIC CONCRETE (HMAC)

PART 1- GENERAL

1.01 DESCRIPTION OF WORK

A. This work includes the furnishing of plant, labor, equipment, and materials and the performance of all operations required for the laying of an overlay of asphaltic concrete.

B. New HMAC cannot be placed without the owner's representative present.

C. New HMAC cannot be placed until crushed limestone base material conforms to project specifications.

PART 2-PRODUCTS

2.01 TYPE OF PAVING

A. This paving shall consist of hot-mixed, hot-laid, Type "D" Asphaltic concrete paving and shall be subject to the specifications as set forth in Item 340 of the latest Texas Highway Department's Standard Specifications for Construction of Highways, Streets and Bridges, except as modified herein.

2.02 TACK COAT:

A. The tack coat shall be a RC-2 cut-back asphalt spread uniformly at a rate of 0.05 gallon per square yard and shall be allowed to cure properly before any further operations are permitted on the area to which they are applied.

PART 3-EXECUTION

3.01 SURFACE TESTS

A. The surface of the pavement, after compression, shall be smooth and true to the established line, grade and cross-section, and when tested with a 16- foot straight edge placed parallel to the centerline of the roadway, it shall have no deviation in excess of 1/16 inch per foot from the nearest point on contact. The maximum ordinate measured from the face of the straight edge shall not exceed 1/4 inch at any point in the surface not meeting these requirements shall be immediately corrected.

END OF SECTION

SECTION 02270 – GRASS SEEDING FOR EROSION CONTROL

PART I - GENERAL

1.01 SECTION INCLUDES:

A. Items required for preparing ground, providing for sowing of seeds and fertilizing, mulching with straw, watering, weed control, and other management practices required for erosion control and to obtain a grass cover. Areas requiring seeding for erosion control will include the drainage ditch embankment and all areas disturbed by construction, including the working easement.

1.02 RELATED SECTIONS:

A. Temporary erosion and sediment control during construction - Section 02150.

B. Site Preparation - Section 02100.

C. Earthwork - Section 02200.

1.03 REFERENCES:

A. TXDOT - Texas Department of Transportation 1993 Standard Specifications for Construction of Highways and Streets and Bridges.

1.04 QUALITY ASSURANCE:

A. Regulatory Requirements:

1. Seed shall comply with U.S. Department of Agriculture rules and regulations under the Federal Seed Act.

2. Bags of fertilizer shall be fully labeled complying with applicable State fertilizer laws and shall bear the name, trade name, trademark, warranty of producer, and analysis of contents.

3. Planting material shall conform to Texas Department of Transportation requirements for rural area species in sandy soils as shown in this Section.

B. Contractors Qualifications:

1. The work of this section shall be performed by a Contractor specializing in seeding and/or landscape installations.
2. Guarantee all materials to be of quality and quantity as specified herein.

C. Water For watering plantings, use water free of impurities injurious to plant growth.

1.05 SUBMITTALS:

A. Certificates of Conformance or Compliance:

1. Seed: Type, purity and germination rate analysis.

2. Fertilizer Manufacture’s, guaranteed analysis.

3. Hydromulch fiber Manufacturer's guaranteed analysis.

4. Tackifier Manufacture’s guaranteed analysis.

1.06 PRODUCT HANDLING:

A. Seed:

1. Furnish seed in sealed standard containers.

2. Seed which has become wet, moldy, or otherwise damaged in transit or in storage shall not be used.

3. Wet moldy, or otherwise damaged seed will be rejected and removed from site.

B. Fertilizer Deliver to site in sealed bags.

PART 2 - PRODUCTS

2.01 MATERIAL:

A. Seed: Refer to Planting Schedule this Section.

B. Fertilizer Complete fertilizer, for use with hydromulch, with minimum 50 percent nitrogen derived from organic sources. The dryweight percentage shall be 18-&12 (N-P-K), also containing zinc and iron.

C. Wood Cellulose Fiber Mulch:

1. Specialty prepared wood cellulose fiber, for use with hydraulic application of grass seed and fertilizer, processed to contain no growth or germination inhibiting factors, and dyed appropriate color to facilitate visual metering of application of materials. Green is preferable.

2. Containing not in excess of 10 percent moisture, air dry weight basis.

3. Fibers become uniformly suspended in slurry tank mixture to form homogeneous slurry.

D. Tackifier Provide a binding agent to hold mulch, fiber and seed in place. Tackifier shall be water-soluble or shall be of remaining in suspension during the application process.

1. Source: Hydro-Tack, N-Tack, or Terra-Tack.

E. Water Free from oil, acid, alkali, salt and other substances harmful to growth of grass.

PART 3 - EXECUTION

3.01 GENERAL:

A. Accomplish seeding and mulching work and seeding and fertilizing work within the planting periods specified in paragraph entitled "Planting Schedule' of this Section.

B. If factors prevail to such an extent that satisfactory results are not likely to be obtained, stop any phase of the work and resume work when desired results are likely to be obtained.

C. Conduct seeding and mulching operations across slope.

D. Accomplish seeding and mulching on all areas disturbed during construction. Including but not limited to excavated areas, fill areas, graded areas, drainage channels, outfall, berms and all borrow and stockpile areas.

3.02 INSPECTION AND TEST:

A. Seed:

1. Each lot of seed may be resampled and retested in compliance with latest rules and regulations under Federal Seed Act at discretion of Owner.

2. Make resampling and retesting by or under supervision of Owner.

3. If these tests reveal seed to be below specified pure live seed content, plant additional seed to compensate for deficiency at no additional cost to Owner.

4. Seed retests: Conducted by approved laboratory.

5. Make allowance for actual pure live seed content of specified grasses in determining actual planting rate.

B. Fertilizers:

1. Retain fertilizer bags and upon completion of project final check of total quantifies of fertilizer used will be made against total area treated.

2. If minimum rates of application have not been met distribute additional quantities of these materials to make up minimum application specified.

C. Mulch: At least five (5) days prior to commencement of mulching operations, notify Owner of sources from which mulch materials are available and quantities thereof.

3.03 SEED BED AND PREPARATION:

A. General:

1. Perform seeding after designated areas for seeding and fertilizing have been graded and smoothed to finished lines and grades and typical cross-sections.

2. Equipment necessary for proper preparation of ground surface and for handling and placing required materials shall be on hand and in good condition before work is started.

B. Grading:

1. Maintain grades on areas to be seeded in true and even condition without ruts or tracks.

2. Maintenance shall include any necessary repairs to previously graded area prior to planting of seed.

C. Tillage:

1. Accomplish in such manner as to prepare seed bed.

2. Use tractors with adequate horsepower and heavy duty tillage equipment to accomplish specified tillage operations.

3. Till areas with heavy duty disc, as necessary, followed by discing with disc harrow, and smoothing with weighted spike tooth harrow, railroad irons, or bridge Umber float drag.

4. Cultivate seed bed so that soil particles on surface are small enough and lie close enough together to prevent seed from being covered too deep for optimum germination.

5. Leave areas smooth for ease of mowing.

6. Depth of tillage: 4 inches.

C. Cleanup:

1. Prior to seeding, clear surface of stone, stumps, or other objects larger than 3 inches in thickness or diameter and of roots, brush, wire, grade stakes, and other objects that might be a hindrance to maintenance operations.

2. Mow, rake and remove vegetation that may interfere with operations from site.

3.04 APPLICATION OF FERTILIZER:

A. Apply fertilizer simultaneously with seed and mulch in hydraulic equipment using specified rate of application.

3.05 PLANTING SEED:

A. General:

1. Conduct seeding equipment calibration tests as means of determining coverage per load to plant seed at specified rates.

2. If unplanted skips are noted after germination and growth of grass, seed unplanted areas with grasses that were to have been planted at no additional cost to Owner.

B. Seeding:

1. Rate of application: Refer to Planting Schedule in this section.

2. Uniformly plant one-half of total amount of seed to depth of 1/4 inch to 1/2 inch by use of approved grain drills, native grass seed drills, Brillion Cultipacker seeder or equivalent, or by broadcasting seed and harrowing or raking lightly to cover seed.

3. Spray on other one-half of total amount of seed with hydraulic equipment in combination with fertilizer and mulch.

3.06 APPLICATION OF MULCH:

A. Area to be seeded shall first be cultipacked with Brillion Cultipacker or equivalent

B. Make application of wood cellulose fiber mulch slurry with hydraulic equipment and accomplish immediately upon completion of final tillage.

C. Hydraulically spray slurry on ground to form blotter-like ground cover uniformly impregnated with grass seed which, after application, will allow absorption of moisture and allow rainfall or mechanically applied watering to percolate to underlying soil.

D. Apply wood cellulose fiber mulch at a rate of 50 pounds per 1000 square feet in combination with fertilizer at rate of 10 pounds per 1000 square feet and seed at rate prescribed in paragraph, "Planting Schedule" in this section. Repeat fertilizer (10 pounds per 1000 square feet) in 40 to 65 days.

E. Use hydraulic equipment application of wood fiber mulch having built-in agitation system with operating capacity sufficient to agitate, suspend, and mix homogeneously slurry containing up to 40 pounds of fiber plus combined total of 70 pounds of fertilizer solids for each 100 gallons of water.

F. Slurry Lines: large enough to prevent stoppage.

G. Accomplish application of mulch slurry same day as completion of final tillage.

H. Keep mulch moist by daily application of water, d necessary, for minimum of ten days or until seeds in mulch have germinated and rooted in soil.

3.07 MAINTENANCE OF TURF:

A. General:

1. Contractor is responsible for maintaining areas during planting period and until other work under contract has been completed.

2. Maintenance shall consist of protection replanting, maintaining existing grades, and repair of erosion damage.

B. Protection:

1. Protect seeded and mulched areas against traffic or other use immediately after seeding is completed.

2. Maintain protection of these areas until completion of work under contract

C. Replanting:

1. Prepare, reseed and remulch areas on which less than six live growing grass plants per square foot are present ten days after planting.

3. Replant as specified for original planting.

3. Perform replanting required without cost to Owner.

D. Maintenance of Grades and Repair of Erosion Damage:

1. Contractor is responsible for maintaining grades of slopes after commencement of planting operations and during maintenance period.

2. Promptly repair any damage to finished surface grades.

3. Promptly repair damage in the event erosion occurs from rainfall or other causes.

4. Correct ruts, ridges, tracts, and other surface irregularities and replant areas where required prior to acceptance.

3.08 WATERING AND MAINTENANCE:

A. Apply water after compaction and seeding. Apply water using portable pipe or hose lines with rotating sprinklers within 24 hours after seeding. Sprinkling may be done with water trucks and hoses in certain locations where it is impractical to use portable lines or hoses. Supervise sprinkling to prevent runoff of water. The Contractor shall furnish all pumps, hoses, pipe lines, water trucks and sprinkling equipment required. Water with approved watering equipment in compliance with the schedule of 14,000 gal/acre weekly for 7 weeks, or as required to achieve grass coverage, whichever is greater. Do not water at rates exceeding 5,000 gal/acre/hr., to prevent runoff.

3.09 WEEDING:

A. Keep all seeded areas relatively free from weeds and undesirable grasses, using approved methods, materials and timing.

3.10 DISEASE AND INSECT/PEST CONTROL:

A. Upon discovery of any disease or insect pest infestation identify or have identified the nature or species of infestation and submit the proposed method of control for approval prior to application of control measures.

3.11 MOWING:

A. Mow the grass should the height reach 3-1/2 inches or greater on the average before final acceptance. Mow to a height of 2-1/2 inches. Mow as required until work is accepted.

3.12 SEEDING:

A. Minimum percentage by weight of pure live seed in each lot of seed shall be as follows: seed planted at rate per acre indicated under pure live seed required per acre. Note: Percent Pure Live Seed = Percent Purity times Percent Germination.

B. Seed shall be treated with fungicide.

C. Weed seed shall not exceed 10 percent by weight of total of pure live seed and other material in mixture.

D. Johnson grass, ragweed, nutgrass or other noxious seed in mixture will be cause for rejection of seed.

IF PLANTING IS TO OCCUR
1 FEBRUARY THROUGH 1 SEPTEMBER

Type of Seed	Minimum Percent Pure Live Seed Required	Pounds Pure Live Seed Required Per Acre
a. Green Spangletop	85	0.6
b. Sideoats Grama (Haskell or Premier)	85	1.8
c. Buffalograss	85	5.3
d. Little Bluestem	85	1.1
e. KR Bluestem	85	0.7
f. Switchgrass (Alamao)	85	1.2
	(Total a + b + c + d + e + f)	10.7

If Contractor begins construction outside the above stipulated allowable seeding dates, additional temporary seeding shall be performed. The temporary seeding shall be performed in addition to other seeding as herein specified. The temporary seeding shall be applied to all areas disturbed by construction per rates as specified below. All cost associated with the additional temporary seeding shall be considered subsidiary to Grass Seeding for Erosion Control.

ADDITIONAL TEMPORARY SEEDING

Minimum

Type of Seed	Percent Pure Live Seed Required		Pounds Pure Live Seed Required Per Acre
a. Tall Fescue	85		4.0
b. Oats	85		21.0
		(Total a + b):	25.0

END OF SECTION

SECTION 02280 - TERMITE CONTROL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification sections, apply to work in this section.

1.2 DESCRIPTION OF WORK:

A. Provide soil treatment for termite control below grade as specified.

1.3 QUALITY ASSURANCE:

A. In addition to the requirements of these specifications, comply with manufacturer's instructions and recommendations for the work, including preparation of substrate and application.
B. Engage a professional pest control operator, licensed by the State of Texas for application of soil treatment solution.

1.4 JOB CONDITIONS:

A. Do not apply soil treatment solution until excavating, filling and grading operations are completed except as otherwise required in construction operations.
B. Ensure penetration; do not apply soil treatment during inclement weather.
C. Comply with other handling and application instructions of the soil toxicant manufacturer.

1.5 SUBMITTALS:

A. Submit four-copies of manufacturer's technical data and application instructions.
B. Include toxicants, composition by percentage, dilution schedule, and intended application rate.

1.6 GUARANTEE:

A. Furnish four-copies of written guarantee certifying that the applied soil poisoning treatment will prevent the infestation of subterranean termites for warranty period.
    1. If subterranean termite activity is discovered during the guarantee period, the Contractor is responsible for re-treat of the soil and repair or replace of damage to the building and its contents caused by termite infestation.
B. Provide guarantee for a period of five years.
C. The Owner reserves the right to renew warranty for an additional 5-year at an additional cost.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable code for requirements for application in accordance with the EPA.
B. Comply with the general requirements of the Florida Building Code.

1.8 PROJECT CLOSEOUT:

A. Record moisture content of soil before application, date and rate of application, areas of application, diary of toxicity meter readings and corresponding soil coverage.

PART 2 PRODUCTS

2.1 SOIL TREATMENT SOLUTION:

A. EPA approved emulsible concentrate insecticide for dilution with water, specially formulated to prevent infestation by termites.
B. Fuel oil is not permitted as a diluent.
C. Provide a working solution of one of the following chemical elements and concentrations:
   1. Dursban T.C.: 1.0% in water emulsion.
   2. Prevail TC: 0.60% in water emulsion.
   3. Pryfom: 0.75% in water emulsion.
D. Other solutions acceptable to local governing authorities and the EPA may be used.
   1. Use only soil treatment solutions, which are not injurious to planting.

PART 3 EXECUTION

3.1 INSPECTION:

A. Before applying soil treatment for termites, examine areas and conditions; notify the Architect in writing of conditions detrimental to the proper and timely completion of the work.
   1. Do not proceed with the work until conditions are satisfactory.
B. Verify that final grading is complete.

3.2 APPLICATION:

A. Surface Preparation:
   1. Remove foreign matter that could decrease effectiveness of treatment on areas to be treated.
   2. Loosen, rake and level soil-requiring treatment, except previously compacted areas under slabs and foundations.
B. Application Rates: Apply soil treatment solution as specified and in strict accordance with Manufacturer's recommendation for mixing and application.
   1. Allow not less than 12 hours for drying after application, before beginning concrete placement or other construction activities.
   2. Post signs in the areas of application warning workers of soil poisoning.
      a. Remove signs before other construction covers the.
   3. Reapply soil treatment solution to areas disturbed by subsequent excavation or other construction activities following initial application.

END OF SECTION

SECTION 02514 – CONCRETE FLATWORK, CURBS, & APPROACHES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of portland cement concrete paving is shown on drawings including walks, curbs, and approaches.

1.03 QUALITY ASSURANCE

A. Codes and Standards: Comply with local governing regulations.

1.04 JOB CONDITIONS

A. Traffic Control:

1. Maintain access for vehicular and pedestrian traffic as required for other construction activities.

2. Utilize barricades and warning signs as required.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

1. Use flexible spring steel forms or laminated boards to form radius bends as required.

2. Coat forms with a nonstaining form release agent that will not discolor or deface surface of concrete.

B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A185. Furnish in flat sheets, not rolls, unless otherwise acceptable to Architect.

C. Reinforcing Bars: Deformed steel bars ASTM A615, Grade 40.

D. Fabricated Bar Mats: Welded or clip assembled steel bar or rod mats, ASTM A184. Use ASTM A615, Grade 40 steel bars, unless otherwise indicated.

E. Joint Dowel Bars: Plain steel bars, ASTM A615, Grade 40. Cut bars true to length with ends square and free of burrs.

F. Concrete Materials:

1. Portland Cement: ASTM C 150, Type I

a. Use one brand cement throughout project, unless otherwise acceptable to Architect.

2. Normal Weight Aggregates: ASTM C33, and as herein specified. Provide aggregates from a single source for exposed concrete.

a. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling causing deleterious substances.

b. Local aggregates not complying with ASTM C33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Architect.

G. Expansion Joint Materials: Contractor shall use pre-formed expansion joint fillers and sealers.

H. Liquid Membrane Forming Curing Compound: Complying with ASTM C309, Type I, Class A unless other type acceptable to Architect. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. “Masterseal”, Master Builders
b. “Clear Seal”, A.C. Horn
c. “Sure Cure”, Kaufman Products, Inc.
d. “Sealkure”, Toch Div. - Carboline
e. “Kure-N-Seal”, Sonneborn-Contech
f. “Sonocrete”, Sonneborn-Contech
h. “L&M Cure”, L&M Construction Chemicals

I. Bonding Compound: Polyvinyl acetate or acrylic base, rewettable type.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. “Weldcrete”, Larsen Products
b. “Everbond”, L&M Construction Chemicals
c. “Hornweld”, A.C. Horn
d. “Sonocrete”, Sonneborn-Contech
e. “Acrylic Bondcrete”, The Burke Co.

2.02 CONCRETE MIX, DESIGN, AND TESTING

A. Design mix to product normal weight concrete consisting of portland cement, aggregate, and water to produce the following properties.

1. Compressive Strength: 3000 psi, minimum at 28 days, unless otherwise indicated.

2. Slump Range: 5” for concrete containing HRWR admixture (super-plasticizer); 3” for other concrete.

3. Air Content: 5% to 8%.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

B. Proof roll prepared subbase surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

3.02 FORM CONSTRUCTION

A. Set forms to required grades and lines rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least twenty four (24) hours after concrete placement.

B. Check completed formwork for grade and alignment to following tolerances:

1. Top of forms not more than 1/8” in 10’.

2. Vertical face on longitudinal axis, not more than 1/4” in 10’.

C. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.

3.03 REINFORCEMENT

A. Locate, place, and support reinforcement as specified in this section unless otherwise indicated on plans.

B. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as herein specified.

C. Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations.

D. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

E. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Engineer.

F. Place reinforcement to obtain at least minimum coverage's for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

G. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.04 CONCRETE PLACEMENT

A. General: Comply with requirements of Division 3 sections for mixing and placing concrete and as herein specified.

1. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

2. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.

3. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

4. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place a construction joint.

B. Fabricated Bar Mats:

1. Keep mats clean and free from excessive rust and handle units to keep them flat and free of distortions. Straighten bends, kinks, or other irregularities or replace units as required before placement. Set mats for a minimum 2" overlap to adjacent mats.

2. Place concrete in 2 operations; strike-off initial pour for entire width of placement and to the required depth below finish surface. Lay fabricated bar mats immediately in final position. Place top layer of concrete, strike-off and screed.

a. Remove and replace portions of bottom layer of concrete which has been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Architect.

C. Curbs and Gutters: Automatic machine may be used for curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results which meet or exceed minimums specified. Machine placement must produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.

3.05 JOINTS

A. General: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the center line unless otherwise indicated.

1. When joining existing structures, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Weakened-Plane (Contraction) Joints: Provide weakened-plane (contraction) joints sectioning concrete into areas as shown on drawings. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness as follows:

1. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.

2. Sawed Joints: (Contractor's Option) Form weakened-plane joints using powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.

C. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for a period of more than 1/2 hour, except where such placements terminate at expansion joints.

1. Construct joints as shown or, if not shown, use standard metal keyway-section forms.

2. Where load transfer slip dowel devices are used, install so that one end of each dowel bar is free to move.

D. Expansion Joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks, and other fixed objects, unless otherwise indicated.

1. Locate expansion joints at 50’ o.c. for each pavement lane, unless otherwise indicated.

2. Extend joint fillers full width and depth of joint and not less than 1/2” or more than 1” below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.

3. Furnish joint fillers in one piece lengths for full width being placed wherever possible where more than one length is required, lace or clip joint filler sections together.

4. Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

E. Fillers and Sealants: Comply with requirements of applicable Division 7 sections for preparation of joints, materials, installation, and performance.

3.06 CONCRETE FINISHING

A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with a 10’ straightedge. Distribute concrete as required to remove surface irregularities and refloat repaired areas to provide a continuous smooth finish.

C. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool and round to 1/2” radius unless otherwise indicated. Eliminate tool marks on concrete surface.

D. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing as follows:

1. Broom finish by drawing a fine hair broom across concrete surface perpendicular to the line of traffic. Repeat operation, if required, to provide a fine line texture acceptable to Architect.

2. On inclined slab surfaces, provide a coarse, non-slip finish by scoring surface with a stiff bristled broom perpendicular to the line of traffic.

E. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up any minor honeycombed areas. Remove and replace areas or sections with major defects as directed by Architect.

3.07 CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

B. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.

1. Provide moisture curing by one of the following methods.

2. Keep concrete surface continuously wet by covering with water.

3. Use continuous water-fog spray.

4. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet.

5. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4-inch lap over adjacent absorptive covers.

6. Provide moisture-cover curing as follows:

a. Cover concrete surfaces with moisture-retarding cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by water proof tape or adhesive.

b. Immediately repair any holes or tears during curing period using cover material and water proof tape.

c. Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walks, and curbs as follows:

i. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen as disappeared).

ii. Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's directions.

iii. Recoat areas subjected to heavy rainfall within 3 hours after initial application.

iv. Maintain continuity of coating and repair damage during curing period.

v. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied to concrete.

3.08 REPAIRS AND PROTECTIONS

A. Repair or replace broken or defective concrete as directed by Architect.

B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

C. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

END OF SECTION

SECTION 02660 - WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 SCOPE

A. The Contractor shall furnish all labor, equipment, and materials and perform all operations necessary to construct a complete, functioning water distribution system.
B. All materials and work performed shall be in accordance with plans, specifications, applicable codes and standards, and of first-class workmanship.

1.2 SAFETY PROVISIONS

A. It shall be the responsibility of the Contractor to protect persons from injury and to avoid property damage.
B. Contractor shall provide and maintain adequate barricades, construction signs, torches, red lanterns and guards during the progress of the construction work and until it is safe for traffic to drive over the trenches in the roadway.
C. Contractor shall perform all construction in a safe manner, specifically, the rules and regulations of the Occupational Safety and Health Administration (OSHA) and the Manual of Uniform Traffic Control Devices (MUTCD).

1.3 REFERENCES

A. City's Minimum Engineering and Construction Standards.
B. Texas Building Codes.
C. Texas Fire Prevention Code.
D. Manual of Uniform Traffic Control Devices (MUTCD)
E. NFPA 24
F. ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings
G. ASTM B88, Standard Specification for Seamless Copper Water Tube
H. ASTM D1248, Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable
I. ASTM D1599, Standard Test Method for Resistance to Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings
J. ASTM D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
K. ASTM D2241, Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
L. ASTM D2737, Standard Specification for Polyethylene (PE) Plastic Tubing
M. ANSI/AWWA C110, American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids - International Restrictions
N. ANSI/AWWA C500, AWWA Standard for Metal-Seated Gate Valves for Water Supply Service - International Restrictions
O. ANSI/AWWA C600, Standard for Installation of Ductile-Iron Water Mains and their Appurtances - International Restrictions
P. ANSI/AWWA C651, Disinfecting Water Mains - International Restrictions
Q. ANSI/AWWA C800, Underground Service Line Valves and Fittings - International Restrictions
R. ANSI/AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution - International Restrictions

1.4 EXISTING UTILITIES

A. Contractor shall provide necessary temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the work at his own expense.

B. Where existing utility structures such as conduits, ducts, pipe branch connections to main sewers, or main drains obstruct the grade or alignment of the pipe, the Contractor shall permanently support, relocate, remove, or reconstruct, the existing structure with the cooperation of the their owners.
   1. Do not deviate from the required line or grade except, as directed, in writing by the Architect.

C. The Contractor shall obtain a Certification number and an existing utility field location at least 48 hours prior to beginning any excavation.

D. Prior to beginning construction, the Contractor shall verify the size, location, elevation, and material of all existing utilities within the area of construction by use of record drawings, electronic locating devices, ground penetrating radar, potholing, or other suitable techniques.

E. Existing utility locations shown on these plans are approximate and identified as either "to remain" or "to be removed".
   1. The Architect assumes no responsibility for the accuracy of existing utilities shown or for any existing utilities not shown.

F. The Contractor is responsible for repairing any damage done during construction to any and all existing utilities.

G. If upon excavation, an existing utility is found to be in conflict with the proposed construction or to be of a size or material different from that shown on the plans; the Contractor shall immediately notify the Architect.

H. Provide water services to each building from the underground water main system, and not from adjacent buildings.

1.5 SHOP DRAWINGS AND SUBMITTALS

A. The Contractor shall provide the Architect a copy of all manufacturers' literature and data for materials installed under this section.
   1. The Architect shall review and stamp the submittals, "Approved" prior to installation by the Contractor.

B. Prior to final approval and acceptance of work, the Architect and other Regulatory Agencies shall review and accept the Contractors "As-Built" documentation.
   1. The Contractor shall provide complete and accurate "As-Built" information relative to manholes, valves, services, fittings, length of pipe, and the like, with the horizontal and vertical information verified by an independent Registered Surveyor to the Architect and other regulatory Agencies.

1.6 APPLICABLE CODES

A. General: All construction and materials shall conform to the Florida Building Code and all local and national codes where applicable.

B. Survey Data: All elevations on the plans or referenced in the specifications are based on National Geodetic Vertical Datum of 1929 (NGVD).

C. Portable water shall comply with the “City’s Minimum Engineering and Construction Standards, Water and Sewer Systems,” and/or the construction standards of any municipality having, jurisdiction.

1.7 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under, Division 1, General Requirements, are included as part of this section.
B. Section 02200 – Earthwork.

PART 2 PRODUCTS

2.1 PIPE

A. OFF-SITE
   1. For water main construction within the public right-of-way and utility easements refer to city, county, or state utility standards and specifications for water main construction within their right-of-way.
B. ON-SITE
   1. The water main shall be either polyvinyl chloride (PVC) pipe or ductile iron pipe (DIP) and shall have push on rubber gasket joints.
   2. Pressure pipe (4" and larger) PVC pipe shall be pressure pipe with iron o.d. class 150 (SDR 18) for domestic water and class 200 (SDR 14) for fire mains, conforming to AWWA C900.
   3. Ductile iron pipe (4" and larger) shall be cement-mortar lined and seal coated, class 150 for domestic water and class 200 for fire mains, mechanical, or push-on joints.
   4. Pressure pipe (under 4") Polyvinyl chloride (PVC) pressure pipe, schedule 40 conforming to ASTM D-1785 or SDR 21 conforming to ASTM D2241 with cement-solvent welded joints.
   5. Miscellaneous: ¾" threaded tie-rods shall be cadmium plated and painted with a coal tar base paint following installation.

2.2 FITTINGS

A. Fittings for ductile iron and PVC pipes (4" and larger) shall have a pressure rating of 250 psi; use mechanical joints and conform to the latest revision of ANSI/AWWA C110.
B. Mechanical joint fittings shall conform to the latest revision of ANSI/AWWA C110.
C. Flanged fittings shall conform to ANSI Specifications for Class 125.
D. Brass fittings shall conform to ANSI/AWWA C800, with all exposed threads covered with a protective plastic coating.
E. Fittings for PVC pipe shall be cast iron mechanical joint type having a pressure rating of 250 psi and conforming to ANSI/AWWA C110.

2.3 VALVES

A. Gate valves 2½" or less in size shall be standard 125 pound, non-rising stem, bronze, double-disc, screwed type, equipped with hand wheel.
B. Gate valves over 2½" shall be resilient seat gate valves with iron body, non-rising stem, fully coated disc with rubber seat ring manufactured in accordance with ANSI/AWWA C500.

2.4 VALVE BOXES

A. Valve boxes shall be of standard extension design manufactured with top cover marked "water."
B. The top section shall be adjustable for elevation and shall be set to allow equal movement above and below grade.
C. Provide valve box appropriate in size for the required valve.
D. Center the base of valve box over the valve and rest firmly on compacted backfill and the entire assembly shall be plumb.
E. Valve boxes shall be like Figure H-10364, as manufactured by Mueller Company, or an approved equal.

2.5 HYDRANTS

A. Hydrants shall have a minimum 6" mechanical joint base pipe connection, 5¼" main valve opening, two 2½" hose nozzles, and one 4½" pumper nozzle.
   1. Threads shall be National Standard.
   2. Hydrants shall be cast iron body, fully bronze mounted, suitable for a working pressure of 150 pounds, and shall be in accordance with the latest specification of the ANSI/AWWA.
   3. They shall be of the O-ring seal type.
   4. Operation nut shall open counter-clockwise and be of the pentagonal shape, measuring 1½" from point to opposite flat.
B. Provide hydrants with a breakaway feature that breaks cleanly upon impact.
   1. This shall consist of a two-part breakable safety flange with a breakable stem coupling.
   2. The upper and lower barrels shall be fluted and ribbed above and below the safety flange or have an extra strength lower barrel.
C. Paint hydrants with one coat of zinc chromate primer and two finish coats of an approved paint of Architect approved color.
   1. Hydrants shall be Number A-423, Traffic type, as manufactured by Mueller Company, or an approved equal.

2.6 SERVICE CONNECTION AND METER

A. The Contractor shall install or have the City install water meters complete with dual backflow preventer, valves and meter vault, at the locations shown on the drawings, and in accordance with the specifications as shown on the drawings.
B. Contractor shall submit shop drawings for meter, valves, and backflow preventer.
C. Contractor is responsible for all costs associated with providing and installing water meters, vaults, backflow preventers, valves, and connections in accordance with the applicable local utility or Palm Beach County Standards.

2.7 SERVICE METERS (3" Maximum)

A. Service water meters shall be of the rotating disc, bronze split case housing type.
B. The meter shall be of the straight reading type, recording flow in gallons, and shall be of the sealed register type.
C. Meters shall conform to applicable specifications of ANSI/AWWA and shall be as manufactured by Neptune Meter Company, or an approved equal.

2.8 METER BOXES

A. Meter boxes shall be precast concrete with a two-piece reinforced concrete cover including a round concrete reading lid. All meter boxes must also meet local utility company requirements.
   1. Meter boxes for ⅝" or ¾" meters shall be Model 36R, as manufactured by Brooks Products, Inc.
   2. Meter boxes for larger meters shall be of suitable size for the enclosed meter.

B. Contractor shall submit shop drawings for meter boxes larger than ¾".

2.9 BACKFLOW PREVENTERS

A. Backflow preventers shall conform to AWWA Standard C506 and shall be of the "reduced pressure principle type".
   1. The backflow preventer shall be provided as an assembly from one manufacturer. The assembly shall include two isolation valves, two check valves, and all other fittings or accessories needed to satisfy referenced design standards.

B. Paint backflow preventers with one coat of zinc chromate primer and two finish coats of an approved paint of Architect approved color.

C. Provide chain and padlock then chain and lock valves on all backflow preventers together.

2.10 PRESSURE GAGES

A. Pressure Gages: Pressure gages for line pressure measurement shall conform to Federal Specifications GG-G-76, Class 1, Style A, Type 1, 3½" diameter with phenolic case, or as indicated on the drawings.

2.11 CHECK VALVES

A. Check valves shall be AWWA standard for 175-psi working pressure, swing type, iron body, or bronze mounted, leather faced disc, suitable for vertical or horizontal position.

B. Valves shall be Mueller Figure A-2600 or approved equal.

C. Where designated on the plans, check valves shall be spring loaded, double half disc wafer check valve, manufactured by TRW Mission, or approved equal.

D. Spring shall be of sufficient tension so valve will close without appreciable slam.

2.12 WATER SERVICES

A. Polyethylene Tubing – Material shall comply with ASTM D1248 and the following:
   1. Polyethylene extrusion compound for extruding the polyethylene tubing shall comply with applicable requirements for PE-3406 or 3408 ultra high molecular weight polyethylene plastic material
   2. Tubing shall have a working pressure rating of 160 psi at 73.4°F.
   3. Tubing must be capable of maintaining pressure of 340 psi at 73.4°F for 1,000 hours when tested in accordance with ASTM D1599.
   4. Tubing surfaces shall be free from bumps and irregularities. Materials must be completely homogeneous and uniform in appearance.
   5. Tubing dimensions and tolerances shall correspond with the valves listed in ASTM D2737 with a standard dimension ratio (SDR) of 9.
   6. Provide label on tubing with brand name and manufacturer, NSF Seal, size, type of plastic material, and ASTM applicable designation with which the tubing complies.

B. Copper tubing shall be type “K” and conform to AWWA Specification 75-CR and ASTM B88 with a working pressure rating of 160 psi at 73.4°F.

C. Other service materials may be considered for specific installations, upon submissions of specification and approval by the Architect.
D. Joints:
    1. Joints for polyethylene or copper tubing shall be of the compression type utilizing a totally confined grip seal and coupling nut.
        a. Provide stainless steel tube stiffener insert for P.E. tubing service.
    2. Other type joints may be considered for specific installations, upon submissions of specifications and approval by the Architect.

2.13 METER VALVES

A. Meter valves shall be of bronze construction in accordance with ASTM B62.
B. Meter valves shall be closed bottom design and resilient "o" ring sealed against external leakage at the top.
C. Provide a shut-off with a resilient pressure actuated seal so positioned in the plug as to completely enclose the flow way in the closed position.
D. The inlet side of all meter valves shall have a compression type fitting as detailed in Section C Part 1.
E. Meter valves for meter size 1" and under shall be equipped with a meter-coupling nut on the outlet sides.
F. Meter valves for 1½" and 2" meters shall have flanged connections on the outlet sides.
G. Provide meter valves over 2" on individual basis for the particular installation.

2.14 CURB STOPS

A. Curb stops shall be of the inverted key type with tee-head shut off.
B. Curb stops shall be made of brass alloy in accordance with ASTM B62.

2.15 CORPORATION STOPS

A. Provide corporation stops manufactured of brass alloy in accordance with ASTM B62.
B. Inlet thread shall be taper thread in all sizes in accordance with ANSI/AWWA C800.
C. Outlet connections shall have a compression type fitting as detailed in Section C Part 1.

2.16 TAPPING SLEEVES

A. Ductile iron tapping sleeves shall be of the mechanical joint type having a flat-faced ductile iron flange, recessed for a tapping valve with all end and side gaskets totally confined.
B. The contractor shall determine the outside diameter of the existing main before ordering the sleeve.

PART 3 EXECUTION

3.1 UNLOADING MATERIAL

A. The Contractor shall exercise care in unloading and handling pipe, valves, fittings, and all other material.
B. Do not drop pipe from trucks or allow pipe to roll against other pipe.

3.2 EXCAVATION

A. All excavation to conform to Section 02200.

3.3 SEPARATION OF WATER AND SEWER MAINS

A. See design plans for water and sewer separation statement and requirements.

3.4 WATER METER

A. Domestic water service; provide a water meter (max. 3") and dual backflow preventer assembly. (Meter bypass with gate valve), (gate valve, meter, gate valve), (bypass reconnection), and (gate valve, backflow preventer, gate valve).
   1. All service pipes for 3" water meter shall be 4" ductile iron pipe with 4" gate valves with flanged fittings for above ground use, and mechanical fittings with retainer glands for underground use.

B. Fire line system; provide a double detector check valve assembly and a fire department connection.
   1. Provide gate valve, (¾" meter bypass with a gate valve and check valve).

C. Locate both assemblies adjacent to property line, and provide either 6' high chain link fence around the assembly or chain lock the valves as indicated on the plans.

3.5 INSTALLATION OF PIPE

A. Obtain permission of the Health Department, Water Department, and the Fire Department having jurisdiction, before installing water mains.

B. All installation of pipe shall conform to AWWA C600.
   1. Do not roll or push pipe into the trench from the bank.
   2. Contractor shall thoroughly inspect all pipes before lowering into the trench, to insure its sound condition and eliminate the possibility of leakage or bursting under test pressure.
   3. Do not use pipes, valves, fittings or any other materials showing defects.
   4. Remove all such defective materials from the construction site immediately.
   5. Before lowering pipe into the trench, swab or brush it to insure that no dirt or foreign matter is in the finished line.

C. Lay pipe on a flat bottom trench and backfill tamped to 6" above the top of the pipe.
   1. Pipe installation shall conform to “Type B Method” as adopted by Committee A21 of the American Standards Association.
   2. Provide a firm even bearing throughout the length of each section of pipe.
   3. Pipe shall not bear on any un-yielding structures, nor shall it support any other structures.
   4. Plug or cap all dead ends, anchor and hold in place with concrete backing as required.
   5. Except while work is in progress, plug all pipe openings to prevent entrance of water or any foreign matter.
   6. Remove material deemed unstable for providing adequate support for pipe and replace with a suitable material.
   7. Provide an adequate backfill material on the pipe to prevent floating, remove and relay any pipe that floats as directed by the Architect.

D. Use one of the three following methods to connect new systems to existing mains:
   1. Method A that involves a reduced size temporary connection between the existing main and the new main.
   2. Method B that involves a direct connection between the new and existing mains using two gate valves separated by a sleeve with a vent pipe.

3. Method C that involves a tap with one gate valve requiring disinfection of the new system prior to conducting the pressure test.

E. The water utility company shall approve and witness the connection method.

3.6 JOINTS

A. All joints shall be suitable for the type of pipe being jointed and shall be made in accordance with manufacturer's recommendations.

B. Mechanical Joints:
   1. Mechanical joints shall be of the stuffing box type.
   2. Place the gland, followed by the rubber gasket over the plain end of the pipe inserted into the socket.
   3. Then push the gasket into position to evenly seat in the socket.
   4. Move the gland into position against the face of the socket, insert bolts and make finger tight.
   5. Using a ratchet wrench suitable to the pipe size, tighten bolts alternately bottom then top, etc., until the joint is complete.

C. Compression Joints:
   1. Compression joints shall be a rubber seal joint, made pressure tight by a molded rubber gasket and lubricant to facilitate assembly.
   2. Make the joint tight by inserting the plain end into the bell after lubrication.
   3. The compression joint shall be similar and equal to "Altite" b as manufactured by Alabama Pipe Company.
   4. Follow the manufacturer recommendations in making up the joints.

D. Flanged Joints:
   1. Use rubber gaskets to make flanged joints, with bolts having rough square hands and hexagonal nuts made to American Standard rough dimensions that are chamfered and trimmed.
   2. Bolts shall be the recommended size for the diameter of pipe being joined and be tightened to evenly distribute the stress in the bolts and bring the pipe in alignment.

3.7 INSTALLATION OF FITTINGS

A. Applicable portions of these specifications shall apply to installation of fittings.

B. Provide reaction or thrust blocking at bends and tees, and where changes in pipe diameter occur at reducers or in fittings.

C. Refer to details for concrete strength and dimensions.

D. Provide restrained joints for all fittings in the public right-of-way.

3.8 INSTALLATION OF FIRE HYDRANTS

A. Applicable portions of these specifications shall apply to installation of fire hydrants.

B. All hydrants shall stand plumb and burial line shall be set at finished grade.

C. Place sufficient concrete thrust blocking as shown on the plans or as directed by the Architect.

3.9 INSTALLATION OF VALVES

A. Applicable portions of these specifications shall apply to installation of valves.
   1. All valves shall stand plumb unless otherwise shown on the plans or directed by the Architect.

2. The operation of installing tapping sleeves and an experienced contractor who has been engaged in this type of work not less than one-year with a representative list of successful installations shall install the valves.

B. Provide appropriate shut-off in a valve box approximately 5' from the building on domestic water line to each building.

3.10 PRESSURE TESTS

A. After adequately backfilling the pipe and at least seven days after placing the last concrete thrust blocking, pressure test all laid pipe for two hours at 150 psi minimum, in accordance with ANSI/AWWA C600-93.
B. The pressure test shall not vary more than ±5 psi during the test.
C. Remove all air is from the pipe prior to pressure tests.
D. The Contractor shall provide such means of venting the pipe as are required.
E. The Contractor shall replace any material or installation proving defective.
F. A representative of the City/County and the Architect shall witness the pressure test.

3.11 LEAKAGE TESTS

A. Bring the main up to test pressure, and hold at this pressure.
   1. Carefully measure make-up water by use of a displacement meter or by pumping the water from a vessel of known volume.
   2. Walk the length of the pipeline and inspect all joints for leakage and movement of pipe.
   3. Repair all visible leaks.
   4. Should any section of pipeline disclose joint leakage greater than that permitted, the Contractor shall, at his own expense, locate and repair the defective joints until leakage is within the permitted allowance.
B. All pipe, etc. shall be tested under a constant pressure of 150 psi (fire main at 200 psi) for a minimum test of two hours and shall not exceed the leakage requirements as per ANSI/AWWA specifications of C600-93 leakage formula:
   1. $Q = \frac{SD\ p5}{133{,}200}$

      Q = allowable leakage in gallons per hour
      S = total length of pipe tested in feet
      D = diameter of the pipe tested in inches
      P = average test pressure in pounds per square inch

3.12 BACKFILL

A. Backfill shall be in compliance with Section 02200 Earthwork.
B. On completion of pressure and leakage tests, the exposed joints shall be backfilled to a depth of 12" above the top of the pipe.
   1. Backfill shall be carefully compacted until 12" of cover exists over the pipe.
   2. Place the remainder of the backfill and compacted thoroughly by puddling and tamping.
   3. When directed, the contractor may backfill the trench neatly rounded to a sufficient height allowing for settlement to grade after consolidation.

3.13 STERILIZATION OF COMPLETED PIPELINE

A. Before final acceptance of completed pipeline, all requirements of the County and State Board of Health shall be satisfied.

1. Forward satisfactory bacteriological test results from these agencies to the Architect.

B. Prior to chlorination of mains, remove all dirt and foreign matter by high velocity flushing through fire hydrants or other approved blow-offs.
   1. Disinfect the main in accordance with the application sections of AWWA C651 and with local health department requirements.

3.14 RESTORATION OF SURFACES AND/OR STRUCTURES

A. The Contractor shall restore and/or replace paving, curbing, sidewalks, fences, sod, survey points, or other disturbed surfaces or structures to a condition equal to that before the work was begun and to satisfaction of the Architect, and shall furnish all labor and materials incidental thereto.
B. Restoration of surfaces and/or structures shall comply with all requirements of the applicable governing agencies including City, Town, County, and State.

3.15 CLEANING UP

A. The Contractor shall remove surplus pipeline material, tools, temporary structures, etc., and as directed by the Architect, shall dispose of all dirt, rubbish, and excess earth.
B. The construction site shall be left clean, to the satisfaction of the Architect

3.16 INSPECTIONS

A. The Contractor shall notify the City, Architect, and the Owner 24 hours prior to beginning construction to arrange the required inspection of the water system.

3.17 PROJECT RECORD DOCUMENTS

A. The Contractor shall maintain accurate and complete records of work items completed.
B. Prior to the placement of any asphalt or concrete pavement, the Contractor shall submit to the Architect, “as-built” plans showing water improvements.
   1. Paving operations shall not commence until the Architect has reviewed the “as-built.”
C. All “as-built” information submitted to the Architect shall be sufficiently accurate, clear and legible to satisfy the Architect that the information provides a true representation of the improvements constructed.
D. Upon completion of construction, the Contractor shall submit to the Architect five complete sets of “as-built” construction drawings and one set of mylars.
   1. Clearly mark these drawings “as-built” show all construction changes and dimensioned locations and elevations of all improvements and signed by the Contractor.
   2. A Professional Land Surveyor registered in the State of Texas shall sign and seal the "As-Built drawings.
E. “As-built” information on the water system shall include vertical and horizontal locations of all valves, fittings, fire hydrants, water services, and connection points.
   1. They shall show the associated pipe size and material type, and must also show the sample points and the sample point numbers must conform to the numbers used on the bacteriological test results.

3.18 FIRE PROTECTION SYSTEM.

A. The domestic water system is separate loop from the fire protection system.

B. Buildings with fire pumps; install the Fire Department connection pipe on the discharge side of the pump.
C. Fire line extension from the main to the building, will be installed by a licensed fire sprinkler contractor. Test fire sprinkler pipe to 200 psi.
D. All fire fighting equipment (fire department connection, hydrants, double detector check valve, and gate valves) to be more than 40' away from the building.
    1. Maintain 7' clearance around each fire hydrant.
E. Provide flow and pressure test reports according to NFPA 24.
F. All points on each building will be within 200' of an existing or proposed fire hydrant.
G. Verify the fire protection water systems and hydrant locations are approved by the fire fighting authority having, jurisdiction.
H. Multi-building campus; provide to each building or group of buildings a fire service pipe that contains a post indicator valve, backflow device, and a fire department connection, and a fire hydrant within 150'.
I. Use ductile iron pipe for fire hydrant branches, fire main service (from the loop to the building), and fire department connections.

END OF SECTION

SECTION 02700 - STORM DRAINAGE UTILITIES

PART 1 GENERAL

1.1 SYSTEM DESCRIPTION

A. The City shall approve drainage system and finish floor elevation.
   1. Do not set finish floor elevation of a new building lower than the existing buildings on the campus without written permission of the Building Official.
   2. Keep buildings and sports-fields a minimum of 12" above adjacent roads and perimeter roads.
B. Design the storm water system like a sanitary sewer system with wye fittings and not with tees and elbows.
C. All drainage systems shall have an outfall to a retention pond, canal, city storm sewer, etc.
   1. Provide storm water branches to roof leaders (8" dia, 1% min. slope).
   2. Storm catch basins shall not be located within ten feet of a sidewalk.
   3. Provide traffic covers as required. Place the word “STORM” on the manhole cover.
D. Interconnect all drainage retention/detention ponds.
E. Connect condensate pipes with backflow valves to the storm drainage system.
F. Contractor shall utilize construction methods and devices such as turbidity curtains and floating silt barricade when necessary to comply with state and local water quality standards.
G. No exfiltration trenches permitted in a municipal or county wellfield.
H. Provide perimeter berms as shown on plan to prevent storm water draining on to adjacent property.

1.2 REFERENCES

A. ASTM C76, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
B. ASTM C131, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
C. ASTM C443, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
D. ASTM C478, Standard Specification for Precast Reinforced Concrete Manhole Sections
E. ASTM C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
F. ASTM C1450, Standard Specification for Non-Asbestos Fiber-Cement Storm Drain Pipe
G. ASTM D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
H. ASTM D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
I. ASTM D3034, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
J. ASTM D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

1.3 SUBMITTALS

A. Submit under provisions of Section 01300.
B. Submit shop drawings with manufacturer’s catalog cuts, technical data, certificate(s) of compliance or certified analysis in accordance with applicable standards on the following:
   1. Pre-cast concrete structures and catch basins
   2. Frames and grates

3. Pipe
4. Test reports
5. Plastic filter fabric

C. Submit complete “as-built” information in the form of Project Record Documents.
   1. Maintain accurate, clear, legible and complete records forming a true representation of the Work completed and in progress.
   2. Provide drawing and specification documentation relative to:
      a. Catch basins, manholes, valves, services, and fittings.
      b. Vertical and horizontal locations of all storm drainage structures, drainage lines, and connection points.
      c. Pipe length, size, and material type.
   3. Registered Surveyor shall be measure and record all horizontal and vertical information and include the information in the project Record Documents.
   4. Project Record Documents: Signed and sealed by the preparing professional Land Surveyor registered in the State of Texas.

1.4 QUALITY ASSURANCE

A. Applicable Codes and Jurisdictional Authorities:
   1. Texas Building Code
   2. Occupational Safety and Health Administration (OSHA)
   3. Manual of Uniform Traffic Control Devices (MUTCD)

B. Inspections: The Builder shall notify the municipal or county, Architect, and Owner at least 48 hours prior to arrange the required inspection of the system.

C. Survey Data: All elevations on the plans or referenced in the specifications are based on National Geodetic Vertical Datum.

D. Provide a copy of the SFWMD application for the “Surface Water Management Permit.”

E. Set parking lot and roadway minimum elevations at the ten-year, one-day storm event.

F. Set playing fields minimum elevations for elementary, middle, and high schools at the ten-year, one-day storm event.

G. If wetland mitigation and/or dredge and fill are required, submit a joint permit application as required by the Texas Department of Environmental Protection and the U.S. Army Corps of Engineers, along with a preliminary mitigation plan.

1.5 RELATED WORK

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work in this section.

B. Section 02200 – Earthwork.

PART 2 PRODUCTS AND MATERIALS

2.1 POLYETHYLENE PIPE AND FITTINGS:

A. Provide high-density corrugated polyethylene smooth interior pipe with annular exterior corrugations.
   1. Provide pipe fittings and accessories of same material and weight/class as pipes, with adjoining method as indicated.
   2. Connect all roof drain with a pre-manufactured welded tee fitting.

B. All materials shall comply with AASHTO M294 Type S, AASHTO M252, ASTM D3350 and ASTM D2321. Joints shall be water-tight in compliance with ASTM D-3212.

C. All pipe and fittings shall be “HI-Q SURE-LOK” as manufactured by Hancor, Inc. or as approved by the Architect.

2.2 STORM SEWER PIPE: POLYVINYL CHLORIDE PIPE:

A. 6" to 8" diameter PVC: SDR 35 conforming to ASTM D3034, with push-on rubber gasket joints.
B. 10" to 12" diameter and larger PVC: PS 10 Perma-Lock with push-on rubber gasket joints similar to those as manufactured by J-M Manufacturing Company, Inc.
C. Polyvinyl-chloride pipe for use in storm sewers connections to building drains shall conform to the requirements of ASTM D1785, for Type II grade 1, Schedule 40.

2.3 REINFORCED CONCRETE PIPE:

A. Conform to ASTM C76, Table III, Wall B, or latest revision.
B. Provide all pipes with modified tongue and groove joints, and have rubber gaskets.

2.4 FIBER REINFORCED CONCRETE PIPE

A. Pipe shall be as manufactured by Hardie Pipe or pre-approved equal.
   1. Hardie pipe shall set the specific performance standard by which we evaluate all proposed substitute products.
B. Pipe shall be 16 foot finished lengths and assembled using rubber gasketed male-female ends.
   1. Form the female joint in pipes with nominal diameters less than 24" by attaching an external bell to the pipe barrel.
   2. Machine both male and female ends of the joint. The pipe joint shall be capable of deflecting up to 1.5° with a non-bell joint and 3° with a bell joint.
   3. The gasket shall conform to the requirements of ASTM C443 and FDOT Standard Specifications for Road and Bridge Construction, Section 449-6, 2004 Edition.
C. Manufacture the pipe in accordance with ASTM C1450 and shall offer a saturated ultimate D-load stress at failure of 2,000 lb/ft/ft.
D. The pipe shall comply with requirements presented in FDOT Standard Specifications for Road and Bridge Construction, Section 449-5, 2004 Edition.
E. The minimum thickness class for Hardie pipe shall be Class III up to and including 18" nominal diameter and Class II for larger sizes. School District Building Department shall pre-approve any lower thickness.

2.5 PLASTIC FILTER FABRIC:

A. Conform to Section 985 of the FDOT Standard Specifications.
B. Provide filter fabric similar to Carthage Mills Filter X or Mirafi.

2.6 CEMENT MORTAR:

A. Provide mortar for manhole construction with one part cement and two parts clean sharp sand, may add lime in the amount not over twenty-five percent (25%) volume of cement.
B. Dry mix and then wet mortar to proper consistency for use.
C. Do not use mortars that have stood for more than one hour after mixing.

2.7 CASTINGS:

A. Castings for inlets and other items: Conform to the ASTM A48, Class 25.

B. Provide castings true to pattern in form and dimensions and free of pouring faults and other defects in positions which would impair their strength or otherwise make them unfit for the service intended.
C. Plugging or filling: Not allowed.

2.8 BALLAST ROCK AND PEA ROCK:

A. Rock shall be clean and free of salinity or any other residue.
B. When subjected to ASTM C131 tests, loss shall not exceed 40%.
C. ½" ballast rock: fall within the ½" to ¾" range.
D. ¾" ballast rock: fall within the ¾" to 2½" range.

2.9 STORM SEWER MANHOLES:

A. General: Provide pre-cast reinforced concrete storm sewer manholes as indicated, complying with ASTM C478.
B. Top: Pre-cast concrete, of concentric cone, eccentric cone, or flat slab top type, as indicated.
C. Base: Pre-cast concrete, with base riser section and integral floor, as indicated.
D. Frame and Cover: Ductile-iron, 26"- diameter cover, heavy-duty, indented top design, with lettering cast into top reading "STORM SEWER."

2.10 CATCH BASINS:

A. General: Provide pre-cast reinforced concrete catch basins as indicated.
B. Basin: Pre-cast reinforced concrete, in accordance with FDOT Standard Specification Section 425, standard index drawings and ASTMC 478.
   1. If above water table, provide sump and drain holes in bottom of catch basin.
C. Frame and Grate: As indicated on drawings, meeting FDOT Standard Specification Section 425
D. Pipe Connectors: Resilient, complying with ASTM C923.

2.11 OUTFALLS:

A. Construct of cast-in-place or pre-cast concrete as indicated, with reinforced headwall, apron, and tapered sides.
   1. Provide riprap as indicated to prevent washout of outfall discharge.
B. Backfilling: Provide backfilling under provisions of Section 02200 - Earthwork
C. Fill Material:
   1. Satisfactory fill material: local sand and rock mixture free of organic material placed in 12" thick loose lifts and thoroughly compacted to a density of not less than 98% of maximum density as determined by the AASHO Method T 180.
   2. The maximum size rocks used in the roadway fill: Classified as A-1, A-2-4, or A-3 conforming to AASHTO M-145 and not containing material which will pass sieve No. 200 by 10% of its total weight.

PART 3 EXECUTION

3.1 PREPARATION

A. Existing Utilities:

1. Provide temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the work.
2. Permanently support, relocate, remove, or reconstruct existing utility structures (such as conduits, ducts, pipe branch connections to main sewers, main drains or other structures).
   a. Deviations from the required line or grade: Not permitted.
3. Contact the Sunshine State One Call Center and verify existing utility field locations at least 48 hours prior to beginning any excavation.
4. Verify the size, locations, elevation, and materials of all existing utilities within the area of construction.

3.2 UNLOADING MATERIALS:

A. Exercise care in unloading and handling pipe, valves, fittings, and all other material.
B. Follow manufacturers requirements.

3.3 EXCAVATION:

A. Excavate pipe trenches to required depths.
B. In general pipes shall have a minimum of 36" cover.
C. If rock is encountered, excavate to a minimum of 6" below bottom of pipe, and backfill trench.
D. Sufficient to allow workmen to perform all operations incidental to constructing the pipeline.
E. Provide hand dug bell holes to permit proper joint making.
F. Pipe bearing on rock: Not permitted.
G. Provide trenching under provisions of Section Earthwork.
H. Pipe Trench Width.
   1. Provide maximum clear width of trench measured at the spring line, without under-cutting the banks, in accordance with the following table.

Size of Pipe (Inches)	Width of Trench (Inches)
6	24
8	36
10	36
12	36
15	36
18	40
21	42
24	48
27	54
30	60
36	66
42	76
48	84
54	91
60	98
66	109
72	112
78	120

2. Minimum width of trench: Leave at least 6" clear space between the bell of pipe and the sheeting or the sides of the trench where no sheeting is used on each side of the bottom without under-cutting the banks.

3.4 PREPARATION OF TRENCH BOTTOM:

A. While preparing the trench bottom or installing pipe, keep water out of trenches.
B. Shape continuous trough to receive the bottom quadrant of the pipe barrel.
C. Carefully prepare trench bottom and place pipe so that pipe is true line and grade.
D. Sand, crushed rock, gravel or pea rock used to support the pipe:
   1. Place materials in the trench bottom 4" minimum below the bottom of the pipe.
   2. Form trough to uniformly support the bottom quadrant of the pipe barrel.

3.5 INSTALLATION

A. PVC Pipe Installation:
   1. In accordance with the Uni-Bell Plastic Pipe Association's "Recommended Practice for Installation of PVC Sewer Pipe."
   2. Grout PVC drainage pipe in place at catch basin walls.
B. Drain and Culvert Pipe:
   1. Comply with TXDOT Standard Specifications for Road and Bridge Construction, Section 125 and 430, 2004 Edition.
   2. Protect pipe during handling against impact shocks and free falls.
      a. Keep pipe clean at all times, and do not use pipe that does not conform to the specifications.
   3. Lay pipe with ends abutting and true to line and grade. Carefully center pipes and lay with a uniform invert.
   4. Accurately lay pipe to the line and grade required for fully functional system.
      a. Prior to making pipe joints, clean and dry all pipe surfaces being joined.
      b. Use lubricant, primers, adhesives, etc., as recommended by the pipe or joint manufacturer's specifications.
   5. Place, fit, joint, and adjust jointing materials or factory fabricated joints in such a manner as to obtain a watertight line.
      a. Provide sufficient backfill material along each side of the pipe to prevent movement of pipe off line and grade.
      b. Compact backfill in accordance with the manufacturer's guidelines to ensure adequate structural support for the pipe.
   6. Install all gravity flow pipes manufactured with bell and spigot joints so the spigot ends point in the direction of flow.
C. Exfiltration Trench: (Not allowed in well fields)
   1. Excavate trench to depths required for drainage capacity.
   2. Place filter fabric and ballast rock to the level of the proposed pipe.
   3. After pipe is laid and accepted, place ballast rock carefully to avoid displacement of pipe and tamp carefully.
   4. Fill trench to level indicated on drawings with ballast rock of size or sizes indicated.
   5. Install filter fabric at top, bottom, and sides, overlapping two feet on top.
   6. Backfill and compact in accordance with requirements of Section 02200 Earthwork.
D. Catch basins: Install per manufacturer's recommendations.
E. Fill and Embankment:
   1. Place roadway fill to within 1/10 (.1) foot of the required elevation.
   2. If improperly fill or settlement, remove fill, refill with new material, compact, smooth, and make to conform to grade.
F. Drainage and Culvert Pipe:

1. Install at elevation and line to provide working system.

3.6 FIELD QUALITY CONTROL

A. Temporary Drainage During Construction
   1. Construct and maintain temporary drainage facilities that may be required to provide drainage relief for the new construction without causing abnormal or adverse flooding impacts to the existing or new facilities.
   2. Temporary facilities may include swales, pipe, etc. as necessary.

B. Restoration of Surfaces and/or Structures:
   1. Restore and/or replace paving, curbing, sidewalks, fences, sod, survey points, or other disturbed surfaces or structures to a condition equal to that before start of work.
   2. Restoration of surfaces and/or structures outside the Owner's property line: comply with requirements of the applicable governing agencies.

C. Cleaning Up:
   1. Remove surplus pipeline material, tools, temporary structures, etc.
   2. Dispose of all dirt, rubbish, and excess earth shall be disposed of off site.

D. Quality Assurance
   1. Provide a visual inspection of the installed system via "lamping" or other method.
   2. Provide mandrel test of all flexible piping systems using a mandrel with an effective outside diameter of at least 95% of the actual pipe inside diameter.
      a. Test will occur 30 days or more after the pipe trench is backfilled.
   3. Repair all visible infiltration regardless of flow rate.
   4. Dig-up all pipe that fails the mandrel test, and relay the pipe and re-backfill, then retest the pipe.
   5. Provide a written summary of test results to the Architect and Owner.

END OF SECTION

SECTION 02730 -SANITARY SEWERAGE UTILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES:

A. Sanitary sewer pipes & fittings.
B. Excavation for pipe trenches.
C. Manholes, covers, and grease traps.
D. Requirements for documentation.

1.2 REFERENCES

A. ANSI/AWWA C110, American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids
B. ANSI/AWWA C151/A21.51, American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water
C. ANSI/AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution
D. ANSI/AWWA C905, Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 In. through 36 In
E. ASTM A48, Standard Specification for Gray Iron Castings
F. ASTM C62, Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale
G. ASTM D1782. Standard Test Method for Operating Performance of Particulate Cation-Exchane Materials
H. ASTM D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
I. ASTM D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
J. ASTM D3034, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

1.3 EXISTING UTILITIES

A. The contractor shall obtain a Certification number at least 48 hours prior to beginning any excavation.
B. Prior to beginning construction, the Contractor shall verify the size, location, elevation, and material of all existing utilities within the area of construction by use of record drawings and/or electronic locating devices.
C. Existing utility locations shown on the plans are approximate and based on available records.
    1. The Contractor is responsible for verifying all utilities, and notifying the Architect of conflicts and variations.
D. The Contractor is responsible for damage to any existing utilities for which he fails to request locations from the utility owner, and for damage to existing utilities that are properly located.
E. The Contractor shall immediately notify the Architect, if upon excavation finds the existing utility in conflict with the proposed construction or of a different size or material from that shown on the plans.

1.4 SHOP DRAWINGS AND SUBMITTALS

A. Submit under provisions of Section 01300.
B. Prior to installation, the Contractor shall furnish to the Architect the manufacturers' literature and data for all materials installed under this section for his approval.
C. Complete As-Built information and plans required before final acceptance of the system.
    1. Contractor shall provide accurate record of complete system relative to manholes, cleanouts, services, fittings, pipe size, pipe material, pipe lengths, and the like.
    2. Registered Surveyor shall provide all horizontal and vertical information in the Contractor's As-Built information.
    3. Final approval of the project "As-Built" information from the regulatory agencies having jurisdiction.
    4. Contractor shall camera the sewer lines and provide the District with a copy of the videotape.

1.5 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work in this section.
B. Section 02200 – Earthwork

1.6 APPLICABLE CODES

A. General: All construction and materials shall conform to the Florida Building Code-Plumbing, all local and national codes where applicable.
B. City’s Water Utilities Department Minimum Engineering and Construction Standards.
C. Construction Safety: Perform all construction in a safe manner; follow Occupational Safety and Health Administration (OSHA) and the Manual of Uniform Traffic Control Devices (MUTCD) regulations.
D. Survey Data: All elevations on the plans or referenced in the specifications are based on National Geodetic Vertical Datum of 1929 (NGVD).

1.7 SANITARY SEWER SYSTEM

A. Gravity sewer, lift station and force main shall comply with the Palm Beach County Water Utilities Department Minimum Engineering and Construction, Water and Sewer Systems, or the construction standards of the municipality having jurisdiction.
    1. Submit a copy of the Texas Department of Environmental Protection Permits.

PART 2 PRODUCTS

2.1 SEWER PIPE AND FITTINGS

A. All sewer pipe and fittings shall be non-pressure polyvinyl chloride (PVC) pipe conforming to ASTM D3034, SDR 35, with push-on rubber gasket joints or ductile iron pipe with a ceramic epoxy lining and bituminous exterior coating.
B. Gravity sewer pipes and force mains in wellfield zones #1 and #2.
    1. Contractor shall have permission from before working in a zone 1 wellfield.
    2. Ductile iron pipe ANSI/AWWA C151/A21.51; ceramic epoxy lined and bituminous exterior coatings.
    3. Polyvinyl chloride pipe, 4" and larger, ANSI/AWWA C900 and ANSI/AWWA C905, dimension ratio DR18.
C. Fittings: PVC and DI pipe, over 4", use ductile iron mechanical joint fittings complying with AWWA/ANSI-C110and having coating/lining per B. Above.

1. All fittings and accessories shall be as manufactured or supplied by the pipe manufacturer or approved equal.

D. In addition to the above-cited specifications, all PVC sewers shall conform to the following additional requirements:
   1. The PVC sewer piping shall be of a product having a dimension ratio (DR) of 35 and minimum pipe stiffness (PS) of 46 psi.
   2. Joints: Use an integral bell gasket joint, designed so that when assembled, the elastomeric gasket inside the bell is compressed radically on the pipe spigot to form a positive seal.
      a. The joint shall avoid displacement of the gasket when installed in accordance with the manufacturer's recommendation.
   3. Use manufacturer's recommended lubricants for joining of the pipes.
      a. No solvent cement joints accepted.
      b. Follow the pipe manufacturer's instructions for the joining of the pipe on the job, complete in the trench unless otherwise directed by the Architect.
   4. Gaskets: Mold all gaskets in a circular form or extruded to the proper section and then splice into circular form, and have a properly vulcanized high-grade elastomeric compound.
      a. The basic polymer being natural rubber, synthetic elastomer or a blend of both.
      b. The gaskets shall be of materials resistant to domestic sewage and as recommended by the manufacturer, with an adequate compressive force so as to affect a positive seal under all combinations of joint tolerance, as the gasket shall be the only element depended upon to make the joint flexible and watertight.
   5. Pipe and Fittings: The pipe shall be made of PVC plastic having a cell classification of 12454-B or 12454-C or 13364-B (with minimum tensile modulus of 500,000 psi) as defined in ASTM D1784.
      a. The fittings shall be made of PVC plastic having a cell classification of 12454-B, 12454-C or 13343-C as defined in ASTM D1782.
      b. Compounds that have different cell classifications because one or more properties are superior to those of the specified compounds are also acceptable.
      c. Clean rework material generated by the manufacturer's own production may be used so long as the pipe or fittings produced meet all the requirements of the specification.
   6. The pipe and fittings shall be homogenous throughout and free from visible cracks, holes, foreign inclusions or other injurious defects.
      a. The pipe shall be as uniform as commercially practical in color, capacity, density and other physical properties.
      b. PVC pipe and fittings showing signs of ultra-violet degradation are not allowed.
   7. Pipe Marking: Clearly mark each standard and random length of pipe in accordance with the following example at intervals of 1.5 M (5') or less:
      a. Manufacturer's Name or Trademark
      b. Nominal Pipe Size
      c. The PVC Cell Classification
      d. The Legend Type e.g.- DR 35 PVC Sewer Pipe
      e. Color: Green.
   8. Fittings Marking: The fittings in compliance with this standard shall be clearly marked per the following example:
      a. Manufacturer's Name or Trademark
      b. Nominal Pipe Size
      c. The Material Designation PVC PSM
   9. Adapters: If field conditions require adapters, install per Architect's direction.
   10. Plugs: Service plugs shall be flexible virgin polyvinyl chloride as supplied by Fernco Joint Sealer Company.

PART 3 EXECUTION

3.1 INSTALLATION GENERAL

A. The contractor shall provide for the furnishing of all labor, equipment, and materials to perform all operations necessary to construct and test the wastewater collection system in accordance with the plans and specifications.
B. Obtain permission from the Health Department and utility company having jurisdiction before install the sewerage systems.
C. Construct on site utilities in accordance with the City's Water Utilities Department Minimum Engineering and Construction Standards.
    1. Materials, installation, cleaning, testing, and disinfection.
D. Waterproof interior of manholes, do not provide ladder rungs, and label covers.

3.2 EXCAVATIONS

A. Keep trenches as nearly vertical as possible and if required, provide sheeting and bracing.
    1. Keep sheeting in place if in the opinion of the Architect or Contractor, damage could result from its removal.
B. Except in rock, water-bearing earth, or where a granular or concrete base is used, stop mechanical excavation of trenches above the final grade elevation laying of pipe on a firm, undisturbed native earth bed.
    1. If over digging occurs, remove all loosened earth and bring the trench bottom back to grade with granular material.
C. Carry excavations and trenches in rock to a depth of not less than 4" below the pipe bottom, and then fill with granular material or washed rock.
D. Width of trenches shall be such as to provide adequate space for placing and jointing pipe properly, keep trench to a minimum width.
E. Remove any unstable soil encountered and replace with gravel, crushed rock, or rock and sand suitably compacted.
F. All excavations shall be in conformance with Section 02200, Earthwork.

3.3 DEWATERING

A. The Contractor shall provide adequate equipment for the removal of storm or surface water that may accumulate in the excavation areas.
B. If the contractor encounters subsurface water, he shall use an approved method to adequately dewater the excavation site so that it is suitably dry for working, form setting, concrete pouring, and pipe installation.
C. This method shall be in place as necessary to maintain the excavation in a dry condition for such operations.
D. All cost for this equipment and work shall be at the Contractor's expense.

3.4 PREPARATION OF TRENCH BOTTOM

A. Do not allow water in the trenches during preparation of the trench bottom or during installation of pipe, unless authorized by the Architect.
B. Shape a continuous trough to receive the bottom quadrant of the pipe barrel.
    1. Excavate bell holes so that after placement, only the barrel of the pipe receives bearing pressure from the trench bottom.

C. Carefully prepare the trench bottom and place the pipe so that when in final position, the pipe is true to line and grade.
D. When sand, crushed rock, gravel or pea rock are used to support the pipe, place such material in the trench bottom a minimum of 4" below the bottom of the pipe, and form the trough as described above to uniformly support the bottom quadrant of the pipe barrel.

3.5 INSTALLATION OF SEWER PIPE

A. Install sewer pipe in accordance with ASTM D2321 and the Uni-Bell Plastic Pipe Association's Recommended Practice for the Installation of PVC Sewer Pipe.
B. Protect pipe during handling against impact shocks and free falls.
    1. Keep pipe clean at all times and do not use pipe that does not conform to the specifications.
C. Start laying the pipe at the lowest point, with spigot ends pointing in the direction of flow.
    1. Lay all pipes with ends abutting and true to line and grade.
    2. Carefully center pipe so that when laid, they will form a sewer with a uniform invert.
    3. Lay pipe in accordance with manufacturer's requirements as reviewed by the Architect.
D. Lay pipe accurately to the line and grade as shown on the plans.
    1. Preparatory to making pipe joints, all surfaces of the portions of the pipe to be jointed or of the factory-made jointing material shall be clean and dry.
    2. Use lubricant, primers, adhesives, etc., as recommended by the pipe or joint manufacturer's specifications.
    3. The jointing materials or factory-fabricated joints shall be placed, fitted, joined and adjusted in such a manner as to obtain a watertight line.
    4. As soon as possible after making the joint, place sufficient backfill material along each side of the pipe to prevent movement of pipe off line and grade.
E. Properly plug the exposed ends of pipe to prevent earth, water or other substances from entering the pipe when construction is not in progress.
F. Properly grout the Harco or approved equal manhole couplings in place at each pipe connection into a manhole wall.

3.6 BACKFILLING TRENCHES

A. Backfill all trenches and excavations immediately after laying pipe unless directed otherwise.
    1. Do not permit water to rise in open trenches after placement of pipe.
    2. Backfilling shall be in compliance with Section 02200.
B. Backfill trenches with approved material free from large clods, stones or rocks larger than 1" in diameter, and carefully deposited in layers, not exceeding 6", until enough fill is placed to provide a cover of not less than 12" above the pipe.
    1. Place each layer, and then carefully and uniformly tamp, so as to eliminate the possibility of pipe displacement.
    2. Place the remainder of backfill material, moisten, and compacted, to 95% of AASHTO Specifications T-180 in landscaped areas and 98% of maximum density in paved areas.
C. Refill, compact, smooth, and make to conform to surrounding grade any trenches improperly filled or settled.
D. Unless otherwise directed, or shown on the plans, backfill in trenches in or through roadways shall be made as specified above, except that the entire fill above 1" over the pipe shall be deposited in layers not to exceed 12" thickness, moistened, and compacted to density equal to greater than that of adjacent material so that pavement can be placed immediately.

3.7 CONCRETE ENCASEMENT OF SEWER PIPE

A. May use mechanical equipment to completely excavate trenches for pipe encasements.
B. Prior to formation of the encasement, in at least two places provide temporary supports consisting of timber, wedges or masonry to support the pipe, one at the bottom of the barrel of the pipe adjacent to the shoulder of the socket, and the other near the spigot end.
C. After the completion of jointing the pipe, uniformly pour concrete beneath and on both sides of the pipe.
    1. Use sufficient concrete so that encasement is at least 4" thick at all points.

3.8 MANHOLES

A. Provide pre-cast concrete manholes with 4000-psi min compressive strength and grade-60 steel.
B. May use other materials with prior approval of the Architect.
C. Construct the manholes to ASTM C-478 requirements and the following:
    1. Minimum wall thickness shall be 8", and the inside diameter of base sections 48".
    2. Provide minimum 8" thick pre-cast reinforced base monolithically casted with the bottom section of manhole walls.
        a. Extend the base slab a minimum of 4" from the outside of the manhole.
    3. Lifting holes through the structures are not permitted.
        a. All holes shall be grout filled to a smooth surface.
    4. Minimum height of base sections shall be 3' from the bottom of base slab.
    5. Join manhole sections with a mastic compound or a round compression ring of neoprene material set in annular spaces cast into the spigot end of a bell spigot-type joint.
        a. Uniformly compress the mastic compound or ring between the sections to form a watertight joint.
        b. After the assembling the sections, point and fill the remaining space in the joint with a dense cement mortar and finish to a smooth, continuous surface inside and outside the wall sections.
    6. Pre-cast manhole cones, when used, shall terminate at such elevations as will permit laying up a minimum of two and maximum of four courses of clay brick under the manhole frame to make allowance for future street grade adjustment.
        a. Approved HDPE adjusting rings may be used in-lieu of brick.
        b. Mechanically attach HDPE rings to the marble frame and the cone.
        c. Submit detail for approval prior to construction.
    7. Use dense, hard burned, common clay brick conforming to ASTM C62 latest revision for manhole construction, brick absorption shall be between 5 and 25 grams of water in one minute by dried brick, set flat face down, in ⅛" of water.
        a. Thoroughly slush all brick with mortar at every corner.
    8. Construction of invert channels shall be:
        a. Smooth and semicircular in shape conforming to inside of adjacent sewer section.
        b. Changes in direction of flow shall be smooth curve of as large a radius as the size of the manhole will permit.
        c. Changes in size and grade of channels shall be gradual and even.
        d. Form invert channels by one of the following methods:
            i) Directly into concrete manhole base, build up with block and mortar, lay half tile in concrete, or
            ii) Lay full section of sewer pipe through manhole and cut out top half after the surrounding concrete has cured; cut shall be smooth and even.
        e. Make the manhole floor outside of channels smooth, and slope toward channels at a slope of 1" per foot.
    9. Where shown on the drawings, the contractor shall place stub outs for future extensions, with a plug marked with a metallic locating device.
    10. Service laterals not permitted through manhole walls.

11. Outside drop connections are required when the vertical distance between pipe inverts exceeds 2'.
    a. Cast required drop connections monolithically with the manhole elements.
12. Cover the entire inside of the manhole with two coats (8 mil each) of Koppers 300M Bitumastic Paint.
    a. Remove all dirt, dust, oils, compounds and other foreign matter, and etch the surfaces with 18% to 20% muriatic acid solution.
    b. Then thoroughly rinsed all surfaces with clean, clear water prior to paint application. Completely dilute the acid solution prior to removal from the system.
13. Jointing and Plastering: Mortar for jointing and plastering shall consist of one part Portland cement and two parts of find sand.
14. Grout the influent and effluent sewers in place using a waterproof, expanding grout, acceptable to the Architect.
    a. Seal all openings and joints watertight.
15. Make all castings for manhole frames and covers of clean even grain, tough gray cast iron.
    a. The castings shall be smooth, true to pattern, and free from projects, sand holes, warp and other defects.
    b. The horizontal surfaces of the frame cover seat and the under surface of the cover which rests upon the cover seat shall be machined.
    c. The cover shall not rock after seating in any position of its associated frame.
    d. Machining is required only on those frames and covers intended for vehicular traffic.
16. Coat castings with coal tar pitch varnish that shall make a smooth coating, tough and tenacious when cold, not tacky and not brittle.
    a. Iron used for castings shall conform to ASTM A48 for Class 30, gray iron.
17. Cast the words "Sanitary Sewer", and the name of the Owner in the cover.
    a. Set the manhole frames and covers so that the top cover is flush with the finished grade or as indicated on the drawings.
    b. The manhole frame and cover type shall be as indicated on the drawings.
    c. Frames will be suitable for the future addition of cast iron rings for upward adjustment of top elevation.
    d. Machine the seating surfaces between frames and covers to fit true.
    e. No plugging or filling is allowed.
    f. Cast pick type lifting holes into lids, but do not go clear through the lid.
18. When a manhole is in low-lying areas or when in the opinion of the Architect an unusual condition exists, a sealed locking type lid may be required.
    a. Installation of this type as directed by the Architect.

3.9 GREASE TRAPS/OIL SEPARATORS

A. Provide concrete grease trap tanks, 1250-gallon max per tank, with 2½" drop between tanks.
    1. Capacity = seats in dining room x part of day x loading factor.
    2. Internal concrete baffle is not required for multiple tanks.
B. Grease traps shall resist floatation at all times, even when empty.
C. In paved vehicle traffic areas, grease trap shall meet H-20 truck loading requirements.
    1. Place top slab reinforcing in the bottom of the slab, not the top.
D. Connect dumpster pad drain to the grease trap.
E. Place two-way cleanouts before, after, and between tanks.
F. Provide traffic covers and drop pipes as required.
G. Provide a neutralizing tank for acid waste pipes before draining into the sanitary system.
H. The effluent from the oil/water separator for vehicle wash down and garage areas shall drain into the sanitary sewer system.

1. The tank shall be as manufactured by Highland Tank Co., Storytown, Pa. or approved equal.
2. The tank shall be doubled wall with a 30-mil thick exterior coating.
3. Have metallic risers with a corrosion-resistant coating, watertight manhole cover (fiber-lite if over 36" dia.), and an electronic alarm panel installed inside the building.
4. Contractor to provide the required dead-man anchors

3.10 CROSSING OF WATER LINES WITH SEWERS

A. Use ductile iron pipe in lieu of PVC pipes in the following conditions.
   1. When sewer line is less than 18" under a water line.
   2. When a sewer line is above a water line.
   3. The pipe is less than 4' from the top grade to the invert of the pipe.
   4. When there is less than 10' of horizontal separation between the water and sewer pipes.

3.11 SEWER TEST

A. On completion of each block or section of sewer, or such other times as the Architect may direct, the block or section of sewer is to be cleaned, tested and lamped.
   1. Each section of the sewer is to show on examination from either end, a full circle of light between manholes.
   2. Each manhole, or other appurtenance to the system, shall be of the specified size and form, to be watertight, neatly and substantially constructed, with the top set permanently to exact position and grade.
   3. All repairs shown necessary by the inspection are to be made; broken or cracked pipe replaced, all deposits removed, and the sewers left true to line and grade, entirely clean and ready for use.
   4. The Architect of Record and the City/County shall witness the sewer lamping.

B. The allowable limits of infiltration or exfiltration for the system, or any portion thereof, shall not exceed a rate of 100 gallons per inch of inside pipe diameter per mile of pipe per 24 hours.
   1. No additional allowance allowed for house service lines.
   2. The allowable limits of infiltration or exfiltration of manholes shall not exceed a rate of four gallons per manhole per 24 hours.
   3. The Architect may direct testing of part or the entire system for infiltration or exfiltration.
   4. Prior to testing for infiltration, pump out the system so that normal infiltration conditions exist at the time of testing.
   5. The amounts of infiltration or exfiltration shall be determined by pumping into or out of calibrated drums, or other Architect approved methods.

C. Conduct the exfiltration test by filling the portion of the system being tested with water to a level equal to the lowest part of the manhole frame.
   1. May substitute an air test for the water exfiltration test upon the Architect, District's Building Department, and the City's approval.

D. Conduct tests on portions of the system not exceeding three manhole sections or 1000'; whichever is greater, unless directed by the Architect.
   1. Run tests continuously for 2 hours.

E. Where infiltration or exfiltration exceeds the allowable limits specified herein, the Contractor shall locate and repair the defective pipe, joints, or other faulty construction.
   1. If the defective portions cannot be located, the Contractor shall remove and reconstruct as much of the work as is necessary in order to conform to the specified allowable limits.
   2. Repair all visible infiltration regardless of test results.

F. The Contractor shall provide all labor, equipment and materials and shall conduct all testing required under the direction of the Architect.
   1. The Contractor shall include the cost of this work in the base bid.

3.12 INSPECTIONS

A. The Contractor shall notify the City and the Architect of Record at least 24 hours prior to beginning construction in order to arrange inspection of the sanitary sewer.

3.13 RESTORATION OF SURFACES AND/OR STRUCTURES

A. The Contractor shall restore and/or replace paving, curbing, sidewalks, fences, sod, survey points, or any other disturbed surfaces or structures to a condition equal to that before the work began and to the satisfaction of the Architect and shall furnish all labor and materials incidental thereto.
B. Restoration of surfaces and/or structures shall comply with all requirements of the applicable governing agencies.

3.14 PROJECT RECORD DOCUMENTS

A. The Contractor shall maintain accurate and complete records of work items completed.
B. All as-built information submitted to the Architect shall be sufficiently accurate, clear and legible to satisfy the Architect that the information provides a true representation of the improvements constructed.
C. Upon completion of construction, the Contractor shall submit to the Architect one complete set of as-built construction drawings.
   1. These drawings shall be marked to show as-built construction changes and dimensional locations and elevations of all improvements and signed by the Contractor.
D. A registered land surveyor shall certify all as-built information for water and sewer lines and submit in a format acceptable to all local reviewing agencies.
E. Contractors shall camera the sewer lines and provide the District with a copy of the videotape.

END OF SECTION

SECTION 03300 - CONCRETE WORK

GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

SUMMARY

Extent of concrete work is shown on drawings.

SUBMITTALS

Product Data: Submit data for non-proprietary materials and items, including admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others as requested by Architect.

Shop Drawings; Reinforcement: Submit original shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACT 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

QUALITY ASSURANCE

Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:

ACT 301 "Specifications for Structural Concrete for Buildings".

ACT 318 "Building Code Requirements for Reinforced Concrete".

Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".

Materials and installed work may require testing and retesting at anytime during progress of work. Retesting of rejected materials for installed work, shall be done at Contractor's expense.

PROJECT CONDITIONS

Protect adjacent finish materials against spatter during concrete placement.

PRODUCTS

FORM MATERIALS

Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.

Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

Provide ties which, when removed, will leave holes not larger than 1" diameter in concrete surface.

REINFORCING MATERIALS

Reinforcing Bars: ASTM A 615, Grade 60 deformed.

Steel Wire: ASTM A 82, plain, cold-drawn steel.

Welded Wire Fabric: ASTM A 185, welded steel wire fabric.

Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI specifications.

For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs. Brick scrap is acceptable.

CONCRETE MATERIALS

Portland Cement: ASTM C 150, Type I, "Alamo Cement" or equal. Use one brand of cement throughout project, unless otherwise acceptable to Architect.

Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.

For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.

Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Architect.

Water: Drinkable.

Water-reducing Admixture: ASTM C 194, Type A, and containing not more than 0.1 percent chloride ions.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"WRDA Hycol"; W.R. Grace.
"PSI N"; Gifford-Hill/American Admixtures
"Eucon WR-75"; Euclid Chemical Co.
"Pozzolith Normal"; Master Builders.
"Plastocrete 160"; Sika Chemical Corp.
"Chemtard"; Chem-Masters Corp.
"Pro-Kete-N"; Protex Industries, Inc.

Water-Reducing, Non-Chloride Accelerator Admixture: ASTM C 494, Type E, and containing not more than 0.1 percent chloride ions.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Accelguard 80"; Euclid Chemical Co.
"Pozzolith High Early"; Master Builders.
"Gilco Accelerator"; Gifford-Hill/America Admixtures

Water-Reducing, Retarding Admixture: ASTM C 494, Type D, and containing not more than 0.1 percent chloride ions.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

"Edoco 20006"; Edoco Technical Products.
"Pozzolith Retarder"; Master Builders.
"Eucon Retarder 75"; Euclid Chemical Co.
"Daratard"; W.R. Grace.
"PSI R"; Gifford-Hill/American Admixtures.
"Plastiment"; Sika Chemical Co.
"Protard"; Protex Industries, Inc.

Prohibited Admixtures: Calcium chloride thyocyanates or admixtures containing more than 0.1 percent chlorine ions are not permitted.

RELATED MATERIALS

Vapor Retarder: Provide vapor retarder cover over prepared base material where indicated below slabs on grade. Use only materials which are resistant to decay when tested in accordance with ASTM E 154, as follows:

Polyethylene sheet not less than 10 mils thick.

Liquid Membrane-Forming Curing Compound: Liquid type membrane-forming curing compound complying with ASTM C 309. Moisture loss not more than 0.055 gr./sq. cm. when applied at 200 sq ft./gal.

Products: Provide the following:

"Sonosil': Sonneborn.

Bonding Compound: Polyvinyl acetate or acrylic base.

Available Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following:

Polyvinyl Acetate (Interior Only):

"Euco Weld"; Euclid Chemical Co.
"Weldcrete"; Larsen Products Corp.

Acrylic or Styrene Butadiene:

"J-40 Bonding Agent"; Dayton Superior Corp.
"Everbond"; L & M Construction Chemicals.
"Hornweld': A.C. Horn, Inc.
"Sonocrete"; Sonneborn-Rexnord.
"Acrylic Bondcrete"; The Burke Co.
"SBR Latex"; Euclid Chemical Co.
"Daraweld C"; W.R. Grace

PROPORTIONING AND DESIGN OF MIXES:

Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACT 301. If trial batch method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.

Submit written reports to Architect and Structural Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect.

Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules:

3000 psi 28-day compressive strength; W/C ratio, 0.58 maximum (non-air-entrained), 0.46 maximum (air-entrained). For structural slabs.

Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

Admixtures:

Use water-reducing admixture in concrete as required for placement and workability.

Use non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).

Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

Ramps, slabs, and sloping surfaces: Not more than 5".

Reinforced foundation systems: Not less than 3" and not more than 5".

Other concrete: Not less than 3" nor more than 5".

CONCRETE MIXING

Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.

During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.

EXECUTION

GENERAL:

Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

FORMS:

Design, erect, support, brace, and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACT 347.

Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.

Construct forms to sizes, shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorage insets, and other features required in work. Use selected materials to obtain required finishes. Solidly but joints and provide back-up at joints to prevent leakage of cement paste.

Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

Provide temporary openings where interior of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

Provisions for Other Trades: Provide openings is concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retightening forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

VAPOR RETARDER INSTALLATION

Following leveling, tamping, and termite treatment of granular base for slabs on grade, place vapor retarder sheeting with longest dimension parallel with direction of pour.

Lap joints 6" and seal with appropriate tape.

PLACING REINFORCEMENT

Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

Avoid cutting or puncturing vapor retarder during reinforcement placement and concreting operations.

Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

JOINTS:

Construction Joints: Locate and install construction joints as indicated or, if not indicated, located so as not to impair strength and appearance of the structure, as acceptable to Architect.

Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise indicated.

INSTALLATION OF EMBEDDED ITEMS

General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

PREPARATION OF FORM SURFACES

Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.

Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

Thin form-coating compounds only with thinning agent of type, amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

Coat steel forms with, if used, a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

CONCRETE PLACEMENT

Replacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or casting. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

Apply temporary protective covering to lower 2' of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.

General: Comply with ACT 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete", and as herein specified.

Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACT 309.

Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly space locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

Bring slab surfaces to correct level within straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

Maintain reinforcing in proper position during concrete placement operations.

Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACT 306 and as herein specified.

When air temperature has fallen to or is expected to fall below 40 deg F (4deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C), and not more than 80 deg F (27 deg C) at point of placement.

Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix design.

Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACT 305 and as herein specified.

Cool ingredients before mixing to maintain concrete temperature at time of placement below 95º deg F (32 deg C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.

Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.

Use water-reducing retarding admixture (Type D) when required by high temperatures, low humidity, or other adverse placing conditions.

FINISH OF FORMED SURFACES

Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.

MONOLITHIC SLAB FINISHES:

Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.

After placing slabs, plane surface to tolerances for floor flatness (F) of 25 and floor levelness (F1) of 20. Slope surfaces uniformly to drains where requires. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.

Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.

After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of F 18 - F 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin firm finish coating system.

After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface procedures a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of F 20 - F 25. Grind smooth surface defects which would telegraph through applied floor covering system.

Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.

Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristly broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

CONCRETE CURING AND PROTECTION

General: Protect freshly placed concrete from premature drying and excessive cold or hot temperature.

Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing.

Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walks, and curbs, as follows:

Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in

accordance with manufacturer's directions. Recoat areas subjected to heave rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing method.

Sealer and Dustproofer: Apply a second coat of specified curing and sealing compound only to surfaces given a first coat.

REMOVAL OF FORMS

Formwork not supporting weight of concrete, such as sides of beams and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

RE-USE OF FORMS

Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

MISCELLANEOUS CONCRETE ITEMS

Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

CONCRETE SURFACE REPAIRS:

Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.

Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

For exposed-to-view surfaces blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture

and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

Repair of Formed Surfaces: Removed and replaced concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.

Correct high area in unformed surfaces by grinding, after concrete has cured at least 4 days.

Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Architect.

Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part portland cement to 2-1/2" parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

Perform structural repairs with prior approval of Architect or Structural Engineer for method and procedure, using specified epoxy adhesive and mortar.

Repair methods not specified above may be used, subject to acceptance of Architect.

QUALITY CONTROL TESTING DURING CONSTRUCTION

The Contractor will employ a testing laboratory to perform test and to submit test reports.

Sampling and testing for quality control during placement of concrete shall include the following, as directed by Architect.

Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.

Concrete Temperature: Test hourly when air temperature is 40 deg F (4 deg C) and below, and when 80 deg F (27 deg C) and above; and each time a set of compression test specimens are required.

Compression Test Specimen: ASTM C 31, one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

Compressive Strength Tests: ASTM C 39; one set for each day's pour exceeding 5 cu yds. plus additional sets for each 50 cu yds. over and above the first 25 cu. yds. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required. When frequency of testing will provide less than 5 strength test for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.

When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

Test results will be reported in writing to Architect, Structural Engineer, and Contractor within 24 hours after tests. Reports of compressive strength test shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

See Structural Plans for additional requirements.

END OF SECTION 03300