

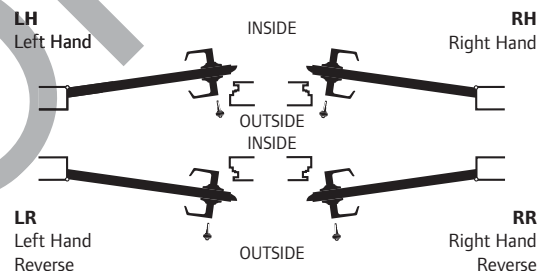
Lever Finishes

								
	605 Bright Brass	606 Satin Brass	612 Satin Bronze	613 Oil Rubbed Bronze	619 Satin Nickel	625 Bright Chromium Plated	626 Satin Chromium Plated	643e Aged Bronze
ND SERIES LOCKS								
Athens	•	•	•	•	•	•	•	•
Omega	•	•	•	•	•	•	•	•
Rhodes	•	•	•	•	•	•	•	•
Sparta	•	•	•	•	•	•	•	•
Tubular	•	•	•	•	•	•	•	•
								NEW IN 2009

e = an equivalent finish to the BHMA standard.

Door Handing

All ND levers are reversible. Hand information is necessary to ensure proper cylinder orientation in keyed functions, and finish of latchbolt and strike for locks that are to be installed on reverse bevel doors. Follow the diagram to correctly determine the hand of the door.



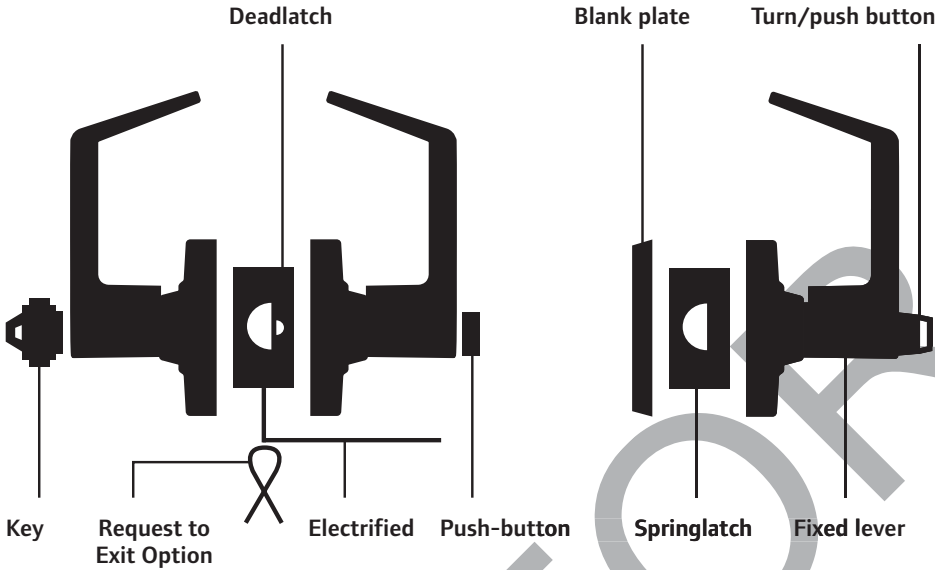
ADA-Compliant Products

In compliance with the American National Standards Institute (ANSI A117.1) and the Americans with Disabilities Act (ADA), Schlage Lock Company offers a wide selection of locks designed for the needs of the physically challenged. This act is designed to provide protection for people with disabilities.

The intent of ADA is that owners of certain types of buildings must remove barriers and provide people with disabilities with access equal to, or similar to, that available to the general public.

Product information and specifications contained in this catalog are subject to change without notice. Please consult the factory.

Lock Functions | ANSI A156.2 Series 4000 Grade 1

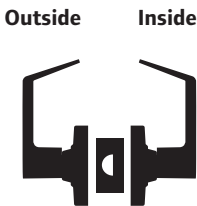


Non-Keyed Locks

SCHLAGE ANSI
ND10S F75

Passage Latch

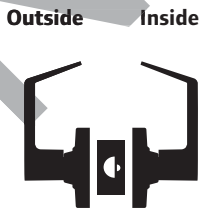
- Both levers always unlocked.



SCHLAGE ANSI
ND12D F89

Exit Lock

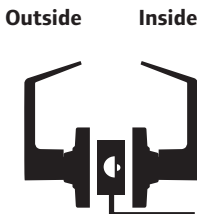
- Outside lever always fixed.
- Inside lever always unlocked.



SCHLAGE ANSI
ND12DEL -

Electrically Locked (Fail Safe)

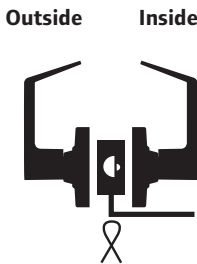
- Outside lever continuously locked electrically.
- Unlocked by switch or power failure.
- Auxiliary latch deadlocks latchbolt when door is closed.
- Inside lever always free for immediate exit.



SCHLAGE ANSI
ND12DEU -

Electrically Unlocked (Fail Secure)

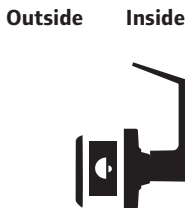
- Outside lever continuously locked until unlocked by electric current.
- Auxiliary latch deadlocks latchbolt when door is closed.
- Inside lever is always free for immediate exit.

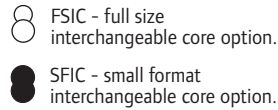
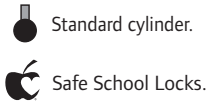


SCHLAGE ANSI
ND25D -

Exit Lock

- Blank plate outside.
- Inside lever always unlocked.





† Caution:
Double cylinder locks are a life safety hazard in times of emergency and their use is not recommended. Installation should be in accordance with existing codes only.

Keyed Locks

SCHLAGE ANSI
ND40S F76

Bath/Bedroom Privacy Lock

- Push-button locking.
- Can be opened from outside with a small screwdriver.
- Turn inside lever or close door to release button.

Outside Inside



SCHLAGE ANSI
ND44S -

Hospital Privacy Lock

- Push-button locking.
- Unlocked from outside by turning emergency turn-button.
- Turn inside lever or close door to release button.

Outside Inside



SCHLAGE ANSI
ND170

Single Dummy Trim

- Dummy trim for one side of door.
- Used for door pull or as matching inactive trim.

Outside/Inside

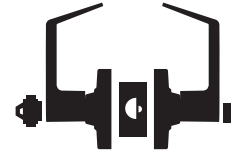


SCHLAGE ANSI
ND50PD F82

Entrance/Office Lock

- Push-button locking.
- Push-button locks outside lever until it is unlocked with key or by turning inside lever.

Outside Inside



SCHLAGE ANSI
ND53PD F109

Entrance Lock

- Turn/push-button locking: Pushing and turning the button locks the outside lever, requiring use of a key until the button is manually unlocked.
- Push-button locking: Pushing button locks outside lever until unlocked by key or by turning the inside lever.

Outside Inside



SCHLAGE ANSI
ND60PD F88

Vestibule Lock

- Latch retracted by key from outside when the outside lever is unlocked by key in inside lever.
- Inside lever is always unlocked.

Outside Inside



SCHLAGE ANSI
ND66PD F91

Store Lock[†]

- Key in either lever locks or unlocks both levers.

Outside Inside



SCHLAGE ANSI
ND70PD F84

Classroom Lock

- Outside lever locked and unlocked by key.
- Inside lever always unlocked.

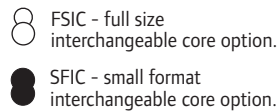
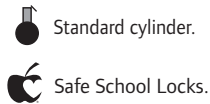
Outside Inside



Lock Functions | ANSI A156.2 Series 4000 Grade 1

Keyed Locks (continued)

SCHLAGE ANSI ND73PD F90 Corridor Lock • Locked or unlocked by key from outside. • Push-button locking from inside. • Turn inside lever or close door to release button. • When outside lever is locked by key it can only be unlocked by key. • Inside lever is always unlocked. Outside Inside	SCHLAGE ANSI ND75PD - Classroom Security Lock • Key in either lever locks or unlocks outside lever. • Inside lever is always unlocked. Outside Inside	SCHLAGE ANSI ND80PD F86 Storeroom Lock • Outside lever is fixed. • Entrance by key only. • Inside lever always unlocked. Outside Inside	SCHLAGE ANSI ND80PDEL - Electrically Locked (Fail Safe) • Outside lever continuously locked electrically. • Unlocked by key outside or by switch or power failure. • Auxiliary latch deadlocks latchbolt when door is closed. • Inside lever always free for immediate exit. Outside Inside
SCHLAGE ANSI ND80PDEU - Electrically Unlocked (Fail Secure) • Outside lever continuously locked until unlocked by key or electric current. • Auxiliary latch deadlocks latchbolt when door is closed. • Inside lever always free for immediate exit. Outside Inside	SCHLAGE ANSI ND82PD F87 Institution Lock† • Both levers are fixed. • Entrance by key in either lever. Outside Inside	SCHLAGE ANSI ND85PD - Faculty Restroom Lock • Outside lever is fixed. • Entrance by key only. • Push-button in inside lever activates visual occupancy indicator, allowing only emergency master key to operate. • Turn inside lever or close door to release visual occupancy indicator. • Rotation of inside spinner-button provides lock-out feature by keeping indicator thrown. Outside Inside	SCHLAGE ANSI ND91PD F82 Entrance/Office Lock • Push-button locking. • Push-button disengages outside lever until locked with key or by turning inside lever. • Vandlgard is designed to disengage outside spindle from latch when locked. Outside Inside



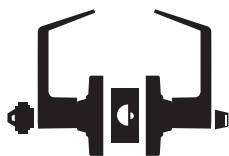
† Caution:
Double cylinder locks are a life safety hazard in times of emergency and their use is not recommended. Installation should be in accordance with existing codes only.

SCHLAGE ANSI
ND92PD F109

Entrance Lock

- Turn/push-button locking: Pushing and turning button disengages outside lever, requiring using of key until button is manually unlocked.
- Push-button locking: Pushing button disengages outside lever until unlocked by key or by turning inside lever.
- Vandlgard is designed to disengage outside spindle from latch when locked.

Outside Inside



SCHLAGE ANSI
ND93PD F88

Vestibule Lock

- Latch retracted by key from outside when outside lever is disengaged by key in inside lever.
- Inside lever is always unlocked.
- Vandlgard is designed to disengage outside spindle from latch when locked.

Outside Inside



SCHLAGE ANSI
ND94PD F84

Classroom Lock

- Outside lever disengaged and unlocked by key.
- Inside lever always unlocked.
- Vandlgard is designed to disengage outside spindle from latch when locked.

Outside Inside



SCHLAGE ANSI
ND95PD -

Classroom Security Lock

- Key in either lever locks or unlocks outside lever.
- Inside lever is always unlocked.

Outside Inside



SCHLAGE ANSI
ND96PD F86

Storeroom Lock

- Outside lever always disengaged.
- Entrance by key only.
- Inside lever is always unlocked.
- Vandlgard is designed to disengage outside spindle from latch when locked.

Outside Inside



SCHLAGE ANSI
ND96PDEL -

Electrically Locked (Fail Safe)

- Outside lever continuously disengaged electrically.
- Unlocked by key outside or by switch or power failure.
- Auxiliary latch deadlocks latchbolt when door is closed.
- Inside lever always free for immediate exit.
- Vandlgard is designed to disengage outside spindle from latch when locked.

Outside Inside



SCHLAGE ANSI
ND96PDEU -

Electrically Unlocked (Fail Secure)

- Outside lever continuously disengaged until unlocked by key or electric current.
- Auxiliary latch deadlocks latchbolt when door is closed.
- Inside lever always free for immediate exit.
- Vandlgard is designed to disengage outside spindle from latch when locked.

Outside Inside



SCHLAGE ANSI
ND97PD F90

Corridor Lock

- Locked or unlocked by key from outside.
- Push-button locking from inside.
- Turning inside lever or closing door releases button.
- When outside lever is locked by key it can only be unlocked by key.
- Inside lever is always unlocked.
- Vandlgard is designed to disengage outside spindle from latch when locked.

Outside Inside



ND-Series Electrified Locks

ND-Series locks are available for electrically locking and unlocking controls for high security and fire safety applications. They are UL Listed and rated for both fire and electrical single-point locking on labeled doors. RX feature is available on ND80 and ND12 families. Switch is ready to be used in a normally open or normally closed application.

Special prep required for RX feature. See service manual for details.

Electrical Requirements

Voltage

24VAC or 24VDC

Holding Current

.15A or .35A

Operating Temperature

Maximum +151°F (+66°C)

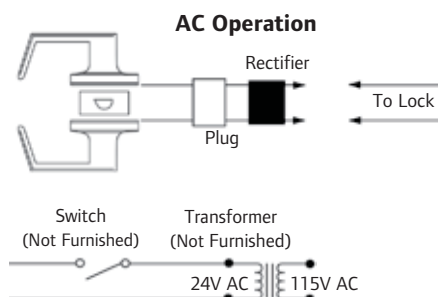
Minimum -31°F (-33°C)

Note: All installations should be in accordance with local electrical codes.



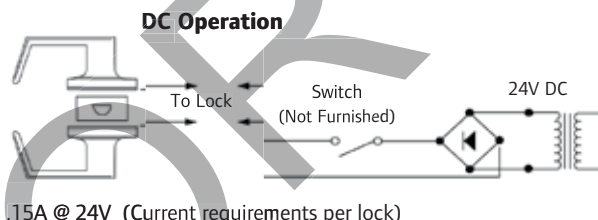
Typical Wiring Diagram for Electrified Locks

AC Power Source – EL or EU



Rectifier used on AC operation unit only.
.35A @ 24V (Current requirements per lock)

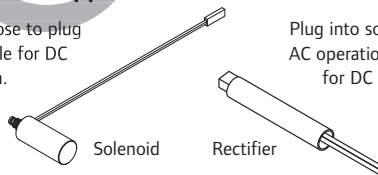
DC Power Source – EL or EU



AC and DC Application

Cut as close to plug as possible for DC operation.

Plug into solenoid for AC operation. Discard for DC operation.



ND-Series Other Special Functions

ND30D

Patio lock

Push button locking. Turning inside lever or closing door releases button, preventing a lock-out. Inside lever always free for immediate egress. Specify per XN12-007.

ND25 x 80PD

Storeroom exit lock

Blank plate outside. Key in fixed inside lever retracts latch. Specify per XN12-005.

ND25 x 70PD

Classroom exit lock

Blank plate outside. Key locks or unlocks inside lever. Specify per XN12-004.

ND60PD

Vestibule with closed outside lever

Same as ND60 except outside lever is closed. Inside lever always free for immediate egress. Specify per XN12-001.

ND70 x 80PD

Classroom by storeroom lock

Key locks and unlocks outside lever. Key in fixed inside lever retracts latch. Specify per XN12-006.

ND72PD

Communicating Lock

Key in either lever locks and unlocks on lever. Specify per XN12-002.

ND72PD

Vandlgard communicating lock

Communicating, ND72, lock with Vandlgard. Key in either lever locks and unlocks own lever. Both inside and outside levers are clutching. Specify per XN12-003.

Full Size Interchangeable Core Availability



A-Series
Orbit design



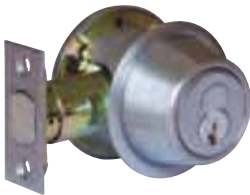
ND-Series lever
all designs



AL-Series
Saturn design



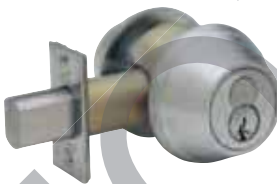
H-Series knob
Orbit design



B500-Series



L-Series
all designs
except concealed



B600 / 700-Series



S-Series
all designs
except Flair



D-Series knob
Orbit design

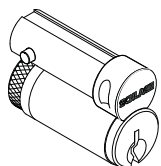


S200-Series
all designs for S210



All except Flair for other functions

Full Size Interchangeable Core Cylinders for Schlage Locksets



Full Size Core Only

Number	Mechanism
23-030	Conventional core
30-120	Conventional core for hotel function (specify hand)
20-740-XP	Primus XP core (not available in hotel function)

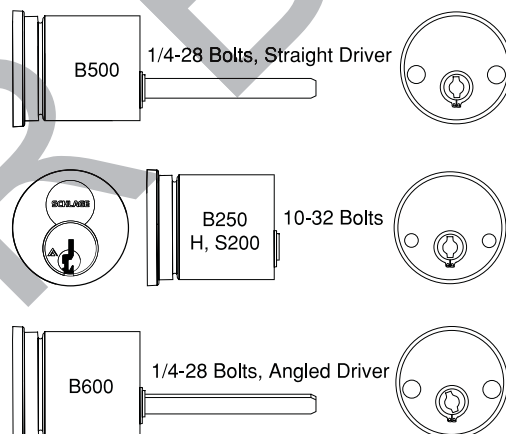
Available 606 and 626 finish only. Order control keys separately.

Full Size IC Housings for Bored Deadlocks, Less Core

Lockset Series	Description	Number	Specify Finish
B500-Series	Outside	B610-203, B610-205	605, 609, 612, 613, 619, 625, 626, and 716
	Inside	B610-028**	605, 609, 612, 613, 619, 625, 626, and 716
B250, H, S200-Series	Outside	22-061	605, 606, 609, 610, 611, 612, 613, 616, 625, 626
	Inside of B252	22-062	
B600 / 700-Series	Outside	B610-027	605, 606, 609, 612, 613, 625, 626
	Inside	B610-028	See Note Below

Specify finish of B610-031 inside snap-on faceplate ordered separately for BC162 and B662/762.

**Inside housing does not include snap-on faceplate



KS43F



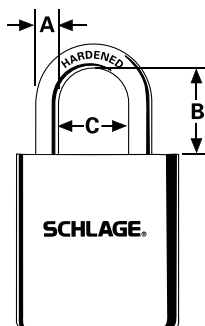
KS72F



KS92M

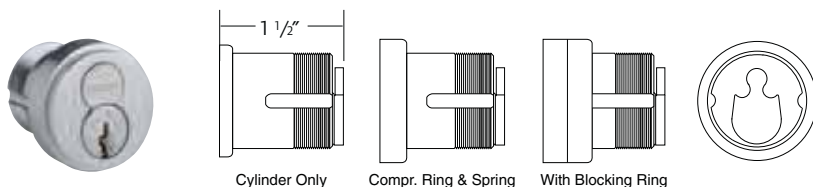
Full Size Interchangeable Core Padlocks

Part #	Shackle Dimensions		
	A	B	C
LESS CYLINDER - FULL SIZE INTERCHANGEABLE CORE			
BRASS BODY			
KS43A3200	3/8"	3/4"	3/4"
KS43D3200	3/8"	1 1/2"	3/4"
KS43F3200	3/8"	2"	3/4"
KS43G3200	3/8"	4"	3/4"
STEEL BODY			
KS72M3200	7/16"	1"	7/8"
KS72F3200	7/16"	2"	7/8"
KS92M3200	3/8"	1"	3/4"



Note: To order Primus XP add the suffix - XP to the Primus part number. (Example: 12-345-XP)

Full Size Interchangeable Core Mortise Cylinders



Cylinders for Schlage L-Series Mortise Locks

	Design	Function	Core Mechanism		
			Conventional	Primus, Primus XP	Housing Less Core
	L & N Escutcheons (cylinders with compression ring)	All Except Below	30-008	20-798, 20-798-XP	30-007
		L9060P Outside	30-030	20-782, 20-782-XP	30-032 + 36-083
		L9485P, L9486P Hotel Functions	30-010*	N/A	30-007
	Sectional Trim (cylinder with compression ring, spring and 3/8" blocking ring). 9060 requires 1/2" blocking ring.	All Except Below	30-138	20-776, 20-776-XP	30-137
		L9060P Outside	30-030 + 36-083 + 35-082-030	20-783, 20-783-XP	30-032 + 36-083 + 36-082-050
		L9485P, L9486P Hotel Functions	30-040*	N/A	30-137



L583-489
Cam for All Functions
Except L9060 Outside



K510-680
Cam for
L9060 Outside

* Hotel function cores are handed. Specify hand of door.

Mortise Cylinders with Straight Cam for Exit Devices

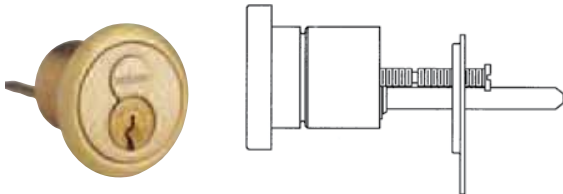
Number	Core Mechanism	Collar
26-091	Conventional core	Compression ring & spring
20-061		3/8" blocking rings + compression ring & spring
20-763, 20-763-XP	Primus/Primus XP core	Compression ring & spring
20-771, 20-771-XP		3/8" blocking rings + compression ring & spring
20-059	Housing less core	None
26-064		Compression ring & spring



K510-730
Straight Cam,
Other Applications

- Notes
1. Available 605, 606, 609, 610, 612, 613, 625, and 626 finish. Cores furnished 606 and 626 only.
 2. To differentiate between Classic and Everest, specify keyway. Example: C or CP (Classic), C123 (Everest). Everest C123 keyway standard.
 3. All cylinders are 1 1/2" long.
 4. Specify LKB if 0-bitted Primus XP cylinders are required less key blanks.

Full Size Interchangeable Core Cylinders for Exit Devices, Aluminum Doors, etc.



Interchangeable Core Rim Cylinders for Exit Devices

Number	Core Mechanism
20-057	Conventional core
20-757	Primus core
20-757-XP	Primus XP core
20-079	Housing only, less core

Available 605, 606, 609, 610, 612, 613, 625 and 626 finish.



Cylinders for Adams Rite MS and 4700 Series Lori 4500 Series and Corbin Russwin DL3000 Series

Number	Core Mechanism	Collar
26-098	Conventional core	Compression ring & spring
20-062	Conventional core	$\frac{3}{16}'' + \frac{3}{8}''$ blocking rings
20-766	Primus core	$\frac{3}{16}'' + \frac{3}{8}''$ blocking rings
20-766-XP	Primus XP core	$\frac{3}{16}'' + \frac{3}{8}''$ blocking rings
20-060	Housing less core	None

These cylinders include set screw pack B220-050 for Adams Rite locks.



K510-711
Adams Rite
MS Cam

Cylinders for Adams Rite 4070 Series Deadlocks

Number	Core Mechanism	Collar
20-091	Conventional core	$\frac{3}{16}'' + \frac{3}{8}''$ blocking rings
20-722	Primus core	$\frac{3}{16}'' + \frac{3}{8}''$ blocking rings
20-722-XP	Primus XP core	$\frac{3}{16}'' + \frac{3}{8}''$ blocking rings
20-090	Housing less core	None



B520-378
Adams Rite
4070 Cam

- Notes
1. Mortise cylinders available 605, 606, 609, 610, 612, 613, 625, and 626 finish. Cores furnished 606 and 626 only.
 2. To differentiate between Classic and Everest, specify keyway. Example: C or CP (Classic), C123 (Everest).
 3. All cylinders are $1\frac{1}{2}''$ long.
 4. Specify LKB if 0-bitted Primus XP cylinders are required less key blanks.

VON DUPRIN®

6100 Series

Strikes for rim exit devices



Overview

Von Duprin electric strikes are known for their reliability, durability and security. The 6100 Series is designed to withstand abuse. Its heavy-duty stainless steel construction is fully UL1034 and UL10C Listed and ANSI/BHMA Grade 1, 1500 lb hold force rated.

6100 Series electric strikes are designed for use with a variety of rim exit devices. They interface with the latch mechanism of the exit device. The movable lip (keeper) allows a door to open even when the latch bolt is extended. This feature, called remote release, provides added benefits such as increased convenience and efficiency. The 6100 Series also provides added security and traffic control.

6100 Series electric strikes can be used for retrofit applications or new construction. To assure the proper selection of an electric strike on new applications, lockset compatibility charts are shown on the next page. When using a lockset not listed or when retrofitting a strike to an existing application, please contact Von Duprin technical support for application assistance.

The power failure mode of the 6100 can be specified at the time of order. Fail-secure is available for fire rated openings. In a fail-secure application, the door is normally locked. To unlock the door, power must be applied. Fail-safe strikes which are commonly used for life safety applications are non-fire-rated. To unlock a fail-safe strike, power is removed. The 6100 comes standard 24 VDC; 12 VDC and AC operation are optional.

Features and benefits

- Non-handed design provides greater flexibility
- Strike box is adjustable to compensate for misalignment of the door or frame
- Two piece plug connectors are furnished for ease of installation and for removal during strike servicing
- ANSI 156.5 Grade 1, 1500 lb hold force rated
- UL1034 burglary-resistant and UL10C electric strike for fire door
- Six finishes available to suite with existing hardware
- Durable stainless steel construction
- 24 VDC standard with 12 VDC and AC operation optional
- Meets BHMA A156.31, Grade 1 for endurance and strength
- Static strength 1500 lbs
- Dynamic strength 70 ft-lbs
- Endurance 1,000,000 cycles
- Allegion Connect option available



Model specifications

Model number		6111	6112	6113	6114	6121
Retrofits model		VD 3031	FA 310-4	VD 3011 VD 3021	FA 310-5	FA 310-4-100
Latchbolt throw		3/4"	3/4"	3/4"	3/4"	3/4"
Face plate length		6"	9"	6"	7"	9 1/8"
Backbox depth		1 3/4"	1 3/4"	1 15/16"	---	N/A
Lockset		Rim exit device	Rim exit device	Rim exit device	Rim nightlatch	Rim exit device
Number of doors	Single	■	■	■	■	---
	Double door with mullion	■	---	---	---	---
	Double door without mullion	---	---	---	---	■
Door/frame type	Hollow metal	■	■	■	■	■
	Aluminum	■	■	■	■	■
	Wood	■	■	■	---	■
Options	Blade stop shim	Yes	No	Yes	No	No
	DS or DS-LC (dual monitor switches)	Yes	Yes	Yes	Yes	Yes
	EB (entry buzzer - fail-secure only)	Yes	Yes	Yes	Yes	Yes
Certifications		UL1034, UL10C, ANSI/BHMA 156.5 Grade 1, 1500 lb hold-force rated				
Application notes		1	2	3	4	5

Note: 16 VDC and 28 VDC solenoid are sold as replacement parts for existing strikes. Please contact customer care for details.

Application notes:

- For use with rim exit devices on single doors or double doors with mullion applications. 1/2" projection blade stop shim 010055-XX available for use on cased opening or blade stop frames. Specify when using 55 rim devices. May also be used with vertical rod exit devices noted on previous page x Pullman latch LBR. Non-fired-rated.
- For use with rim exit devices on single door applications. Designed to replace Folger Adam 310-4, minor frame prep modification required.
- 1/2" projection blade stop shim 010055-XX available for use on cased opening or blade stop frames. **Non-fire rated.**
- Surface applied strike for use with rim nightlatches on single door applications. Designed to replace Folger Adam 310-5, with different mounting hole locations from Folger Adam.
- Non-fire rated.** For use with rim exit devices on double door applications without mullion. Strike mounts on inactive leaf. Replace Folger Adam 310-4-100.

Rim exit device compatibility 6111, 6112, 6113 & 6121 strikes

Manufacturer	Device
Von Duprin	22, 33A, 35A, 55 ¹ , 88, 98, 99 8827 LBR ⁴ x Pullman latch Non-Fire rated 9827 LBR ⁴ x Pullman latch Non-Fire rated 9927 LBR ⁴ x Pullman latch Non-Fire rated
Falcon Monarch ²	XX-R, 18-R, 19-R, 24-R, 25-R
Falcon Doromatic	1790
Precision ²	2100
Sargent	2800, 6500, 6800, 8500, 8800, 9500, 9800 ³ , 9898
Yale	1500, 700

- Strike must be factory modified, specify when using with a 55 Rim device
- Deadlocking feature will not properly function, consult factory
- Panic only, Not fire-rated
- 6111 is recommended for LBR applications

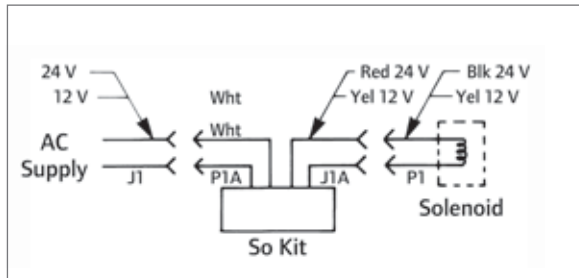
Note: When using a lockset not listed or when retrofitting an existing application, please contact Von Duprin technical support for application assistance

6100 Series specifications

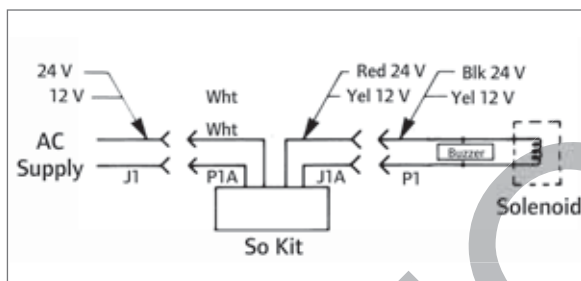
	12VDC	24VDC
Resistance in ohms +/- 10% @ 70F	21	82
Watt-seated @ 70F	7.5	8
Amps-seated @ 70F	0.6	0.33
Amps-inrush @ 70F	0.6	0.33

Wiring

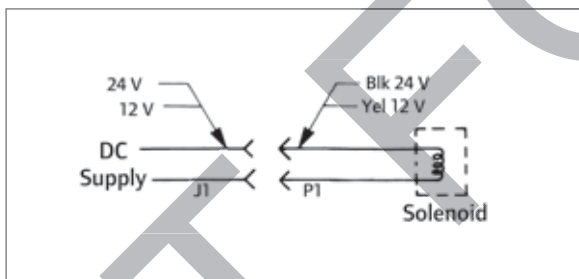
AC



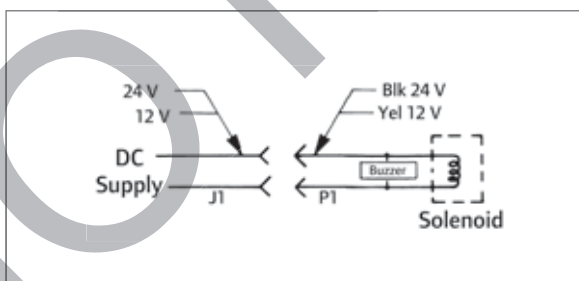
AC with buzzer



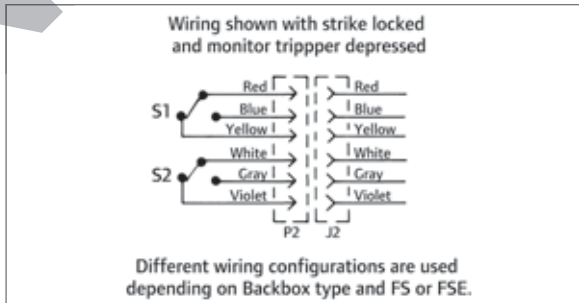
DC



DC with Buzzer

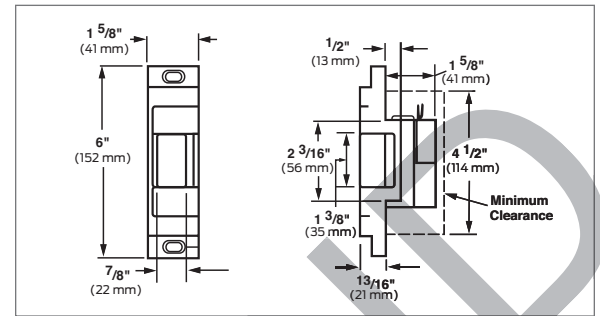


Optional DS (FSE Shown)

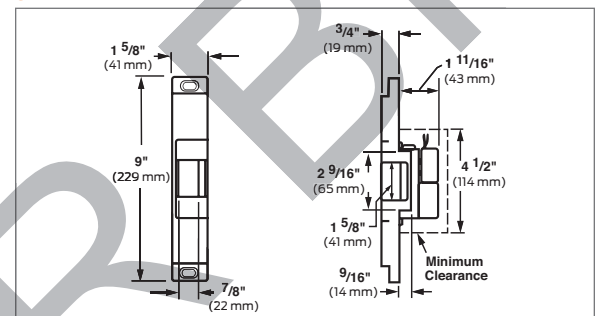


Dimensions

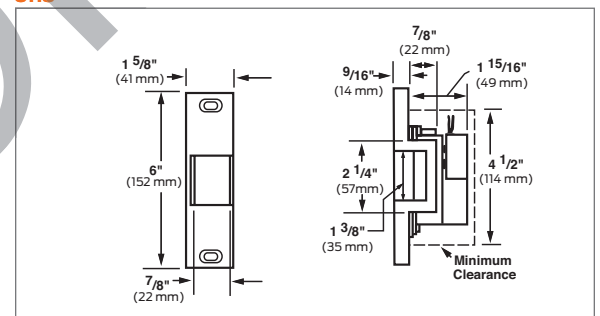
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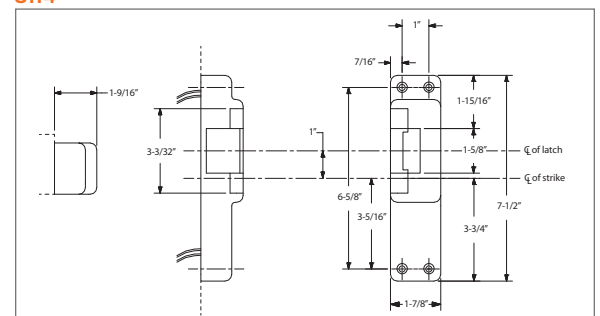
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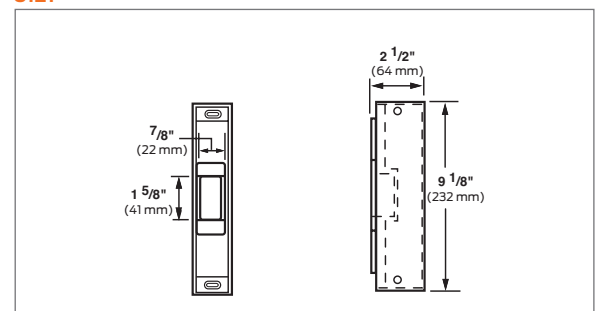
6113



6114



6121



Ordering information

6112-FSE-DS-24-S024-US3-EB-CON

Model	Power failure mode	Dual switch*	Voltage	Rectifier kit*	Finish	Buzzer*	Allegion Connect*
1	2	3	4	5	6	7	8

* Optional

Selections correspond with the numbers above

1	Model
6111	See chart on page 3 to make the proper selection
6112	See chart on page 3 to make the proper selection
6113	See chart on page 3 to make the proper selection
6114	See chart on page 3 to make the proper selection
6121	See chart on page 3 to make the proper selection
2	Power failure mode
FSE	Fail-secure. Requires power to be applied to unlock the strike lip. On loss of power, the strike lip is locked. Fire-rated.
FS	Fail-safe. Requires power to be applied to lock the strike lip. On loss of power, the strike lip is unlocked. Non-fire-rated.

3	Dual switch (optional)
DS	Monitors latch bolt and lock status. DS switches rated at 24 VDC 50 milliampere - 2 amps.
DS-LC	Optional for computer monitoring. Monitors latch bolt & lock status. DS switches rated 24 VDC 50 milliampere or less.
4	Voltage (VDC)
24	Low voltage DC power
12	Low voltage DC power
If AC power is required specify rectifier kit below.	
5	Rectifier kit (optional)
S012	Converts 12 VAC voltage to 12 VDC to operate the solenoid
S024	Converts 24 VAC voltage to 24 VDC to operate the solenoid

6	Finish US number/Von Duprin number
US3/85	Plated polished brass on stainless steel
US4/84	Plated dull brass on stainless steel
US10/06	Plated dull bronze on stainless steel
US10B/86	Plated dark bronze on stainless steel
US32/31	Stainless steel, polished
US32D/32	Stainless steel, satin
7	Buzzer (optional)
EB	Entry Buzzer
Only available if Fail-Secure (FSE) is specified.	
8	Allegion Connect
CON	Allegion Connect Connector
6 in. wire extension harness available	

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VON DUPRIN®

6200 Series

Strikes for mortise or cylindrical devices



Overview

Von Duprin electric strikes are known for their reliability, durability and security. The 6200 Series is designed to withstand abuse. Its heavy-duty stainless steel construction is fully UL1034 and UL10C Listed and ANSI/BHMA Grade 1, 1500 lb hold force rated.

6200 Series electric strikes are designed for use with a variety of mortise or cylindrical locksets, as well as mortise exit devices. It interfaces with the latch mechanism of the exit device. The 6200 Series movable lip (keeper) allows a door to open, even when the latch bolt is extended. This feature, called remote release provides added benefits such as increased convenience and efficiency. The 6200 Series also provides added security and traffic control.

6200 Series electric strikes can be used for retrofit applications or new construction. To assure the proper selection of an electric strike on new applications, lockset compatibility charts are shown on the next page. When using a lockset not listed or when retrofitting a strike to an existing application, please contact Von Duprin Technical Support for application assistance.

The power failure mode of the 6200 Series can be specified at the time of order. Fail-secure is available for fire rated openings. In a fail-secure application, the door is normally locked. To unlock the door power must be applied. Fail-safe strikes, which are commonly used for life safety applications, are non-fire rated. To unlock a fail-safe strike, power is removed. The 6200 Series comes standard with 24 VDC; 12 VDC and AC operation are optional.

Features and benefits

- Non handed design provides greater flexibility
- Strike box is adjustable to compensate for misalignment of the door or frame
- Two piece plug connectors are furnished for ease of installation and for removal during strike servicing
- ANSI 156.5 Grade 1, 1500 lb hold-force rated
- UL1034 Burglary-Resistant and UL10C Electric Strike for Fire Door
- Six finishes available to suite with existing hardware
- Durable stainless steel construction
- 24 VDC standard with 12 VDC and AC operation optional
- Meets BHMA A156.31, Grade 1 for endurance and strength
- Static strength 1500 lbs
- Dynamic strength 70 ft-lbs
- Endurance 1,000,000 cycles
- Allegion Connect option available

6200 Series specifications

	12VDC	24VDC
Resistance in ohms +/- 10% @ 70F	21	82
Watt-seated @ 70F	7.5	8
Amps-seated @ 70F	0.6	0.33
Amps-inrush @ 70F	0.6	0.33

Mortise lockset compatibility^{1,3}

6211, 6211AL, 6211WF, 6212, 6213, 6214, 6215, 6221, 6222, 6223, 6224, 6224AL, 6225 and 6226 strikes

Manufacturer	Model number
Von Duprin	7500
Adams Rite	4510, 4710
Baldwin	6000
Best	24H, 30H
Corbin	9000
Falcon	M2300, M2500, M2600, M3300, M3500, M3600
Precision	Mortise
Russwin	Mortise
Sargent	7700, 8100, 9000
Schlage	L9000, K30, K40, K50, K60
Yale	7030, 7130, 8600, 8700

Mortise lockset compatibility^{1,3}

6210

Manufacturer	Model number
Von Duprin	7500
Best	30H (not 45H/47H)
Corbin/Russwin	ML2200, 5000, 9000, CR2200 (not 2000)
Falcon	M100, M200, M300, M400, M500, M600
Sargent	7700, 8100 (not 7800/8200)
Schlage	L9000
Yale	8700 (not 8800)

Cylindrical lockset compatibility^{1,3}

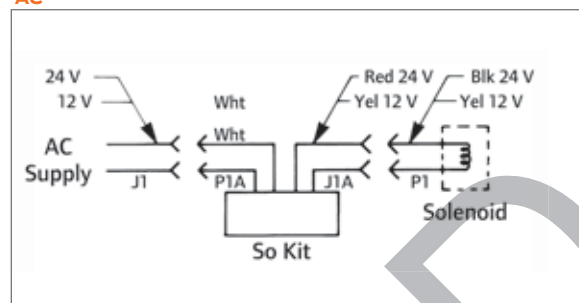
6211, 6211AL, 6211WF, 6212, 6213, 6214, 6215, 6221, 6222, 6223, 6224, 6224AL, 6225 and 6226 strikes

Manufacturer	Cylindrical latchbolt projection
Baldwin	1/2" - 3/4" (13 mm - 19 mm)
Best	3/8" - 3/4" (10 mm - 19 mm) ²
Corbin	1/2" - 3/4" (13 mm - 19 mm)
Falcon	1/2" - 3/4" (13 mm - 19 mm)
Russwin	1/2" - 3/4" (13 mm - 19 mm)
Sargent	1/2" - 3/4" (13 mm - 19 mm)
Schlage	3/8" - 3/4" (10 mm - 19 mm) ²
Yale	1/2" - 3/4" (13 mm - 19 mm)

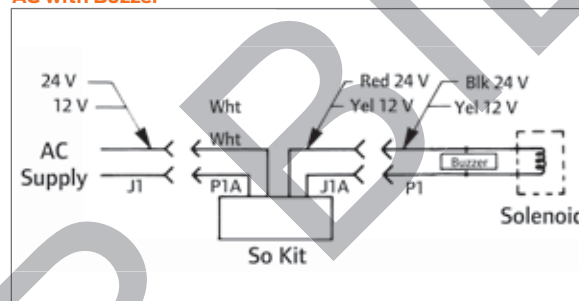
1. Von Duprin cannot guarantee compatibility, as other manufacturer's designs may change without notice.
2. Signalling may not function when using 3/8" (10 mm) throw bolt. Deadlocking cannot be guaranteed with all locks.
3. When using a lockset not listed or when retrofitting a strike to an existing application, please contact Von Duprin Technical Support for assistance.

Wiring

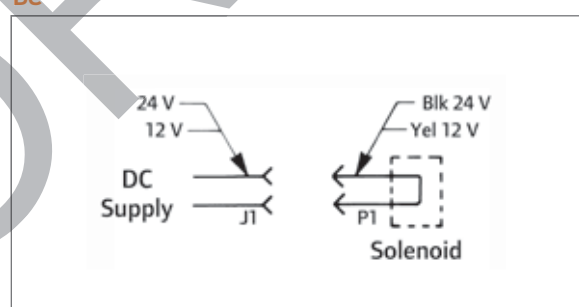
AC



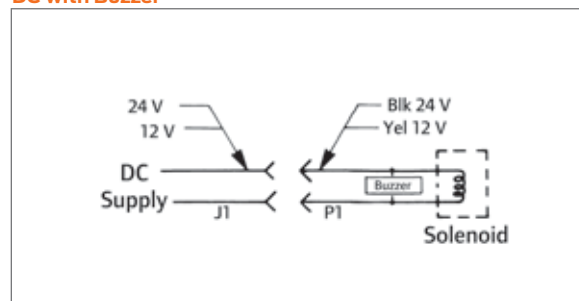
AC with Buzzer



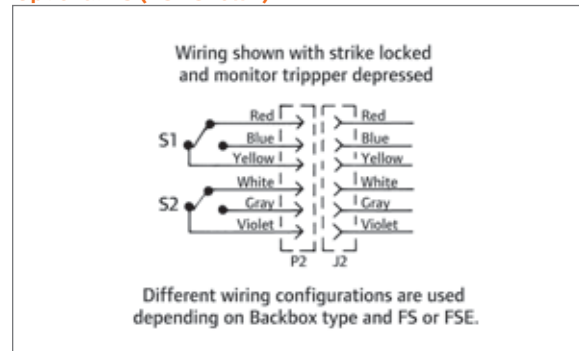
DC



DC with Buzzer



Optional DS (FSE Shown)



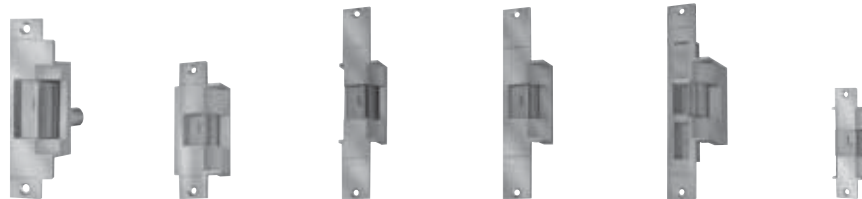


Model specifications

Model number		6210	6211	6211AL	6211WF	6212
Retrofits model		N/A	VD 3140 FA 712	FA 722	FA 732	VD 3146
Latchbolt throw		3/4"	3/4"	3/4"	3/4"	3/4"
Face plate length		4 7/8"	4 7/8"	4 7/8"	4 7/8"	6 3/8"
Backbox depth		1 21/32"	1 21/32"	1 21/32"	4 1/2"	1 21/32"
Lockset	Mortise	■	■	■	■	■
	Cylindrical	---	■	■	■	■
Number of doors	Single	■	■	■	■	■
	Pair	---	---	---	---	---
Door and frame type	Hollow metal	■	■	---	---	■
	Aluminum	■	■	■	---	■
	Wood	---	---	---	■	---
Options	DS or DS-LC (dual monitor switches)	■	■	■	■	■
	EB (entry buzzer - fail-secure only)	■	■	■	■	■
	28 VDC AC rectifier kit	■	■	■	■	■
	16 VDC solenoid	■	■	■	■	■
Certifications	UL1034	■	■	■	■	■
	UL10C	■	■	■	■	■
	ANSI/BHMA 156.5 Grade 1 1500 lb Hold force rated	■	■	■	■	■
Application Notes		1	2	3	4	5

Application notes:

- For use with mortise locks without deadbolt on single door, hollow metal frame applications and using ANSI prep at standard height. Strike pocket inserts are provided to accommodate different manufacturers deadlocking trigger locations.
- For use on new installations with mortise locks without deadbolt or cylindrical locks on single door, hollow metal frame applications. Designed to replace Von Duprin 3140 or Folger Adam 712.
- For use on new installations with mortise locks without deadbolt or cylindrical locks on single door, aluminum frame applications.
- For use on new installations with mortise locks without deadbolt or cylindrical locks on single door wood frame applications. Designed to replace Folger Adams 732. Wood frame horizontal solenoid location differs from Folger Adams. Requires additional frame prep when retrofitting.
- For use with mortise locks without deadbolt or cylindrical locks on single door, hollow metal or aluminum frame applications. Fits modified ANSI 115.2 cutout. Designed to replace Von Duprin 3146.

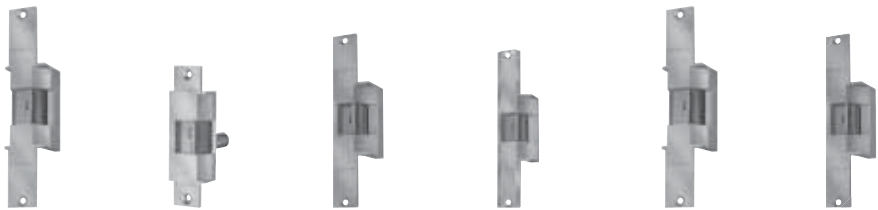


Model specifications

Model number		6212WF	6213	6214	6215	6216	6221
Retrofits model		N/A	VD 3041 VD 3042 VD 3061 VD 3062	FA 310-2 3/4	FA 310-2	FA 310-3-1	VD 3071 VD 3072
Latchbolt throw		3/4"	3/4"	3/4"	3/4"	3/4"	3/4"
Face plate length		6 3/8"	6"	9"	9"	9"	6"
Backbox depth		4 3/4"	2 1/2"	1 5/8"	1 5/8"	3 5/32"	4 3/4"
Lockset	Mortise	■	■	■	■	■	■
	Cylindrical	■	■	■	■	■	■
Number of doors	Single	■	■	■	■	■	---
	Pair	---	---	---	---	---	■
Door and frame type	Hollow metal	---	■	■	■	■	■
	Aluminum	---	■	■	■	■	■
	Wood	■	See note 2 below	---	---	■	■
Options	DS or DS-LC (dual monitor switches)	■	■	■	■	■	■
	EB (entry buzzer - fail-secure only)	■	■	■	■	■	■
	28VDC AC rectifier kit	■	■	■	■	■	■
	16VDC solenoid	■	■	■	■	■	■
Certifications	UL1034	■	■	■	■	■	■
	UL10C	■	■	■	■	■	■
	ANSI/BHMA 156.5 Grade 1, 1500 lb hold force rated	■	■	■	■	■	■
Application notes		1	2	3	4	5	6

Application notes:

- For use with mortise locks without deadbolt or cylindrical locks on single door, wood frame applications.
- For use with mortise locks without deadbolt or cylindrical locks on single door hollow metal or aluminum frame applications (includes wood frame on retrofit applications). Designed to replace Von Duprin 3041, 3042, 3061 and 3062.
- For use with mortise locks without deadbolt or cylindrical locks on single door hollow metal or aluminum frame applications. Designed to replace Folger Adams 310-2 3/4.
- For use with mortise locks without deadbolt or cylindrical locks on single door hollow metal or aluminum frame applications. Designed to replace Folger Adams 310-2.
- For use with mortise locks with deadbolt 1" throw on single door hollow metal aluminum or wood frame applications. Deadbolt must be manually operated. Designed to replace Folger Adams 310-3-1.
- Open back electric strike for use with mortise locks without deadbolt or cylindrical locks on 1 3/4" (44 mm) thick double door applications. 4 3/4" (120 mm) minimum stile required. For a concealed vertical rod and mortise device combination, specify "A" backbox.



Model specifications

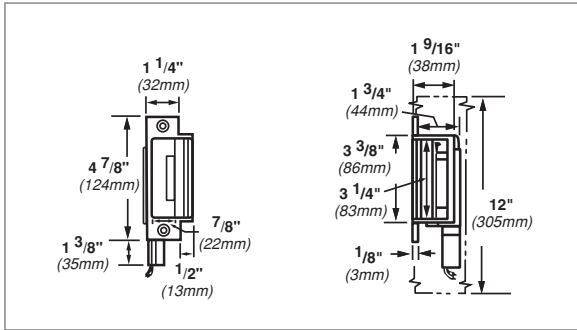
Model number		6222	6223	6224	6224AL	6225	6226
Retrofits model		FA 310-2 ¾ OB	VD 3091 VD 3092	FA 310-2 ¾	FA 310-2RF	FA 310-2 OB	FA 310-2
Latchbolt throw		¾"	¾"	¾"	¾"	¾"	¾"
Face plate length		9"	6"	9"	9"	9"	9"
Backbox depth		1 ⅝"	4 ½"	1 ⅝"	1 ⅝"	1 ⅝"	1 ⅝"
Lockset	Mortise	■	■	■	■	■	■
	Cylindrical	■	■	■	■	■	■
Number of doors	Single	---	---	---	---	---	---
	Pair	■	■	■	■	■	■
Door and frame type	Hollow metal	■	■	■	---	■	■
	Aluminum	■	■	■	■	■	■
	Wood	---	■	---	---	---	---
Options	DS or DS-LC (dual monitor switches)	■	■	■	■	■	■
	EB (entry buzzer - fail-secure only)	■	■	■	■	■	■
	28VDC AC rectifier kit	■	■	■	■	■	■
	16VDC solenoid	■	■	■	■	■	■
Certifications	UL1034	■	■	■	■	■	■
	UL10C	■	■	■	■	■	■
	ANSI/BHMA 156.5 Grade 1, 1500 lb hold force rated	■	■	■	■	■	■
Application notes		1	2	3	4	5	6

Application notes:

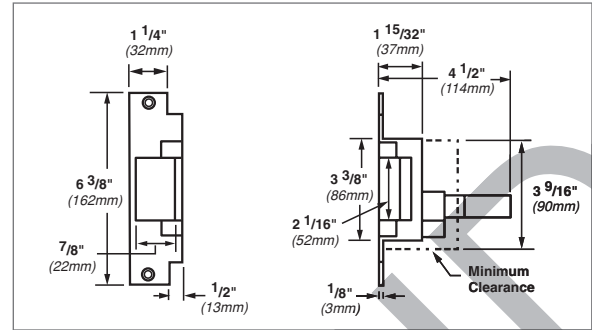
1. Open back electric strike for use with mortise locks without deadbolt or cylindrical locks on 1 ¾" (44 mm) thick double door applications
2. Closed back electric strike for use with mortise locks without deadbolt or cylindrical locks on 1 ¾" (44 mm) thick double door applications. 4 ¾" (120 mm) minimum stile required. For a concealed vertical rod and mortise device combination specify "A" backbox.
3. Closed back electric strike for use with mortise locks without deadbolt or cylindrical locks on 1 ¾" (44 mm) or 2 ¼" (57 mm) thick double door applications.
4. Closed back electric strike for use with mortise locks without deadbolt or cylindrical locks on 1 ¾" (44 mm) or 2 ¼" (57 mm) thick aluminum double door applications.
5. Open back electric strike for use with mortise locks without deadbolt or cylindrical locks on 1 ¾" (44 mm) thick double door applications.
6. Closed back electric strike for use with mortise locks without deadbolt or cylindrical locks on 1 ¾" (44 mm) or 2 ¼" (57 mm) thick double door applications.

Dimensions

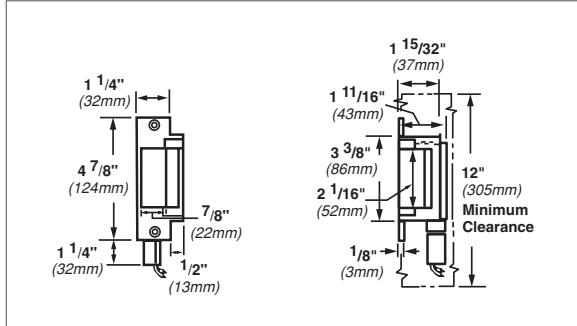
6210



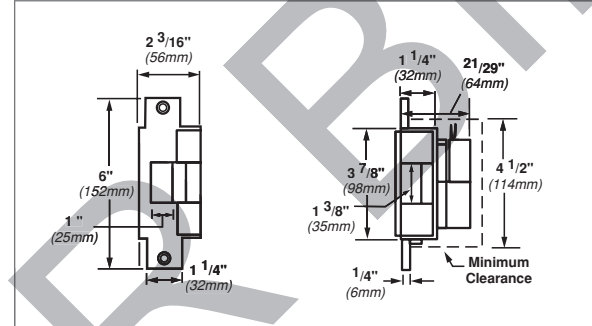
6212WF



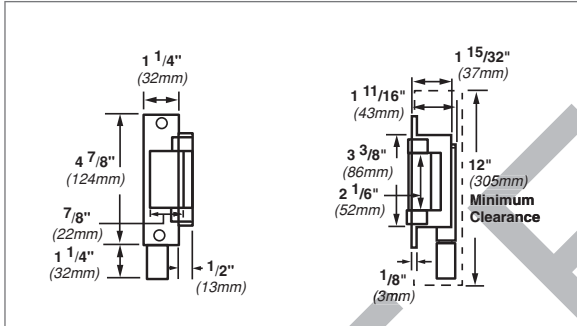
6211



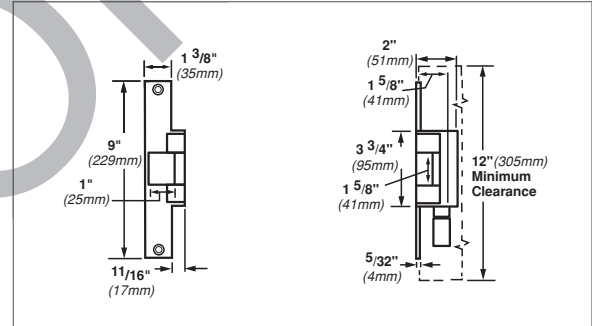
6213



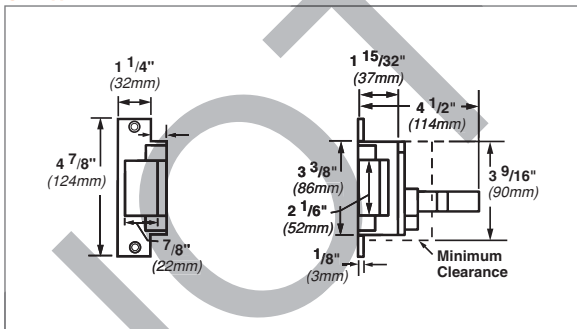
6211AL



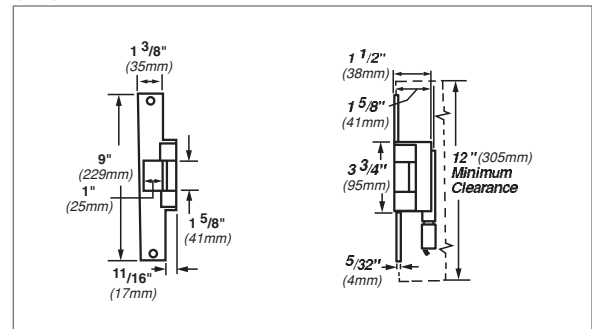
6214



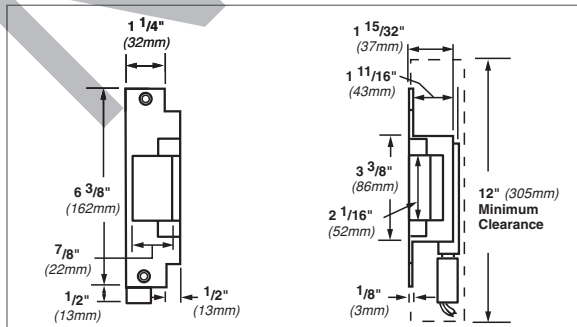
6211WF



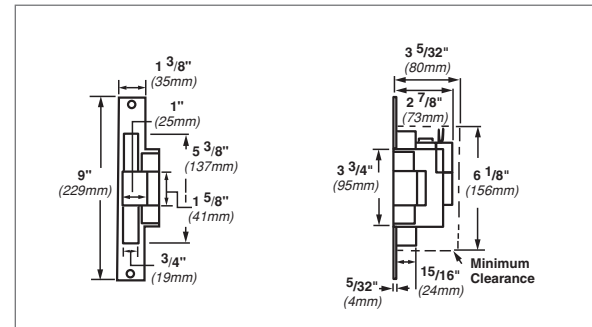
6215



6212

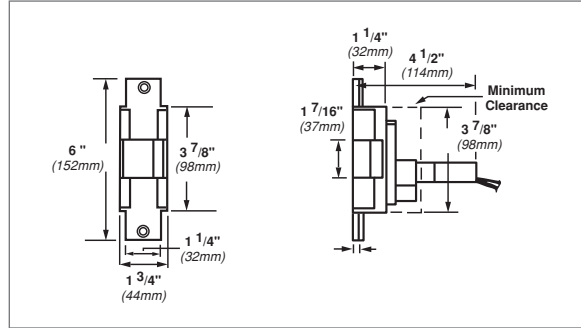


6216

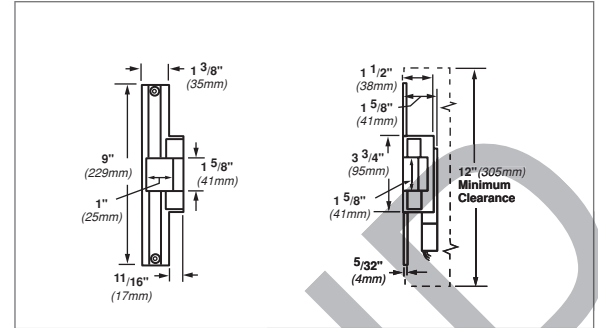


Dimensions

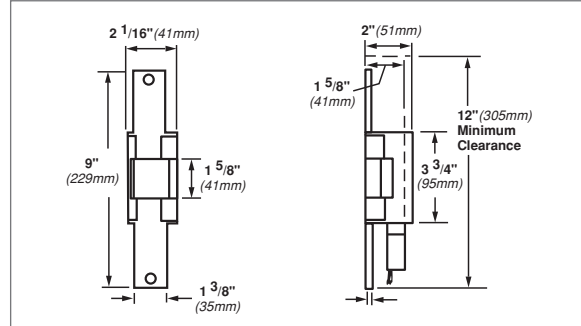
6221



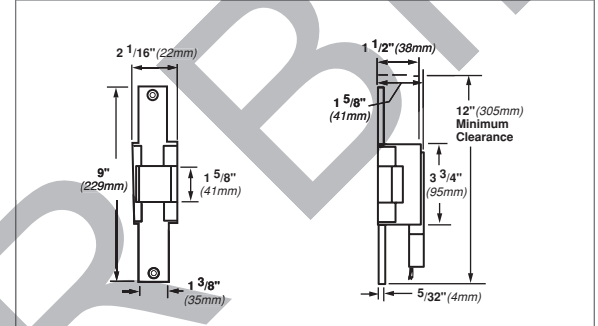
6224AL



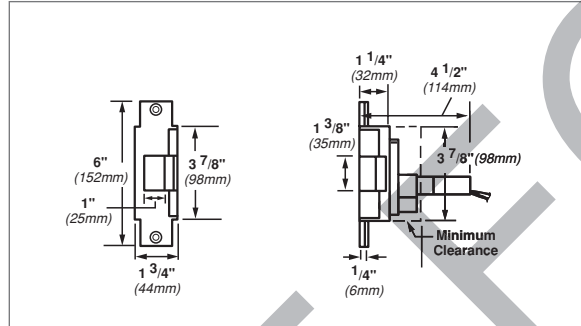
6222



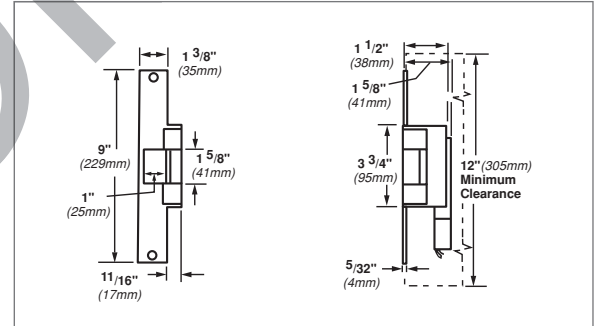
6225



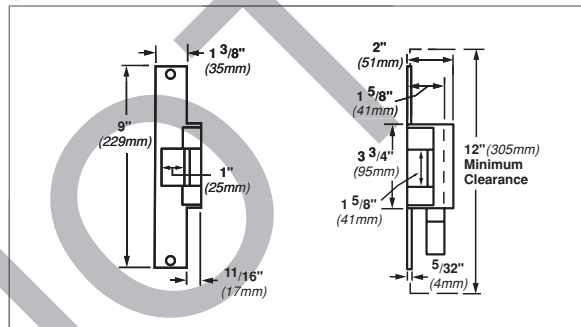
6223



6226



6224



Ordering information

6210-FSE-DS-24-S024-US3-EB-CON

Model	Power failure mode	Dual switch*	Voltage	Rectifier kit*	Finish	Buzzer*	Allegion Connect*
1	2	3	4	5	6	7	8

* Optional

Selections correspond with the numbers above

1	Model
6210	See chart on page 3 to make the proper selection
6211	See chart on page 3 to make the proper selection
6211AL	See chart on page 3 to make the proper selection
6211WF	See chart on page 3 to make the proper selection
6112	See chart on page 3 to make the proper selection
6212WF	See chart on page 4 to make the proper selection
6213	See chart on page 4 to make the proper selection
6214	See chart on page 4 to make the proper selection
6215	See chart on page 4 to make the proper selection
6216	See chart on page 4 to make the proper selection
6221	See chart on page 4 to make the proper selection
6222	See chart on page 5 to make the proper selection
6223	See chart on page 5 to make the proper selection
6224	See chart on page 5 to make the proper selection
6224AL	See chart on page 5 to make the proper selection
6225	See chart on page 5 to make the proper selection
6226	See chart on page 5 to make the proper selection

2	Power failure mode
FSE	Fail-secure. Requires power to be applied to unlock the strike lip. On loss of power, the strike lip is locked. Fire-rated.
FS	Fail-safe. Requires power to be applied to lock the strike lip. On loss of power, the strike lip is unlocked. Non-fire-rated.
3	Dual switch (optional)
DS	Monitors latch bolt and lock status. DS switches rated at 24 VDC 50 milliampere - 2 amps.
DS-LC	Optional for computer monitoring. Monitors latch bolt & lock status. DS-LS switches rated 24 VDC 50 milliampere or less.
4	Voltage (VDC)
24	Low voltage DC power
12	Low voltage DC power
If AC power is required, specify rectifier kit below.	
5	Rectifier kit (optional)
S012	Converts 12 VAC voltage to 12 VDC to operate the solenoid
S024	Converts 24 VAC voltage to 24 VDC to operate the solenoid

6	Finish US number/Von Duprin number
US3/85	Plated polished brass on stainless steel
US4/84	Plated dull brass on stainless steel
US10/06	Plated dull bronze on stainless steel
US10B/86	Plated dark bronze on stainless steel
US32/31	Stainless steel, polished
US32D/32	Stainless steel, satin
7	Buzzer (optional)
EB	Entry Buzzer. Only available if Fail-Secure (FSE) is specified.
8	Allegion Connect
CON	Allegion Connect Connector
6 in. wire extension harness available	

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005368, Rev. 08/14
www.allegion.com/us

Rabbeted Thresholds



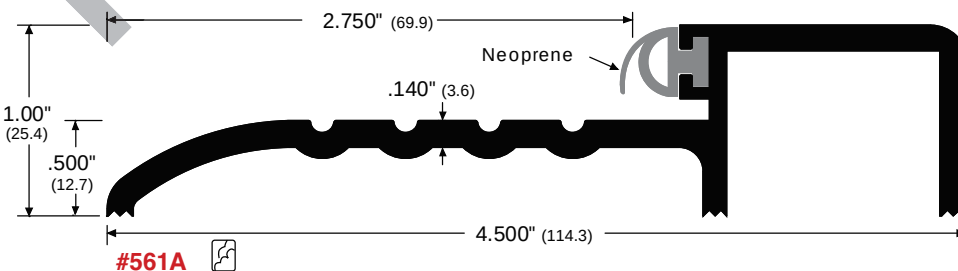
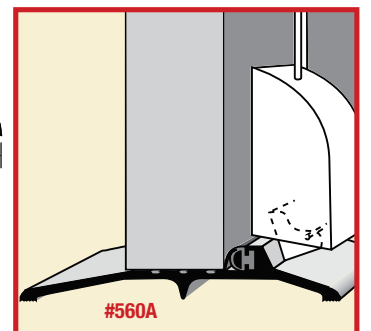
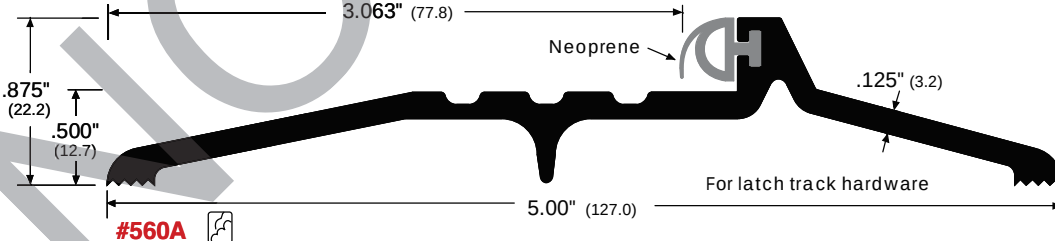
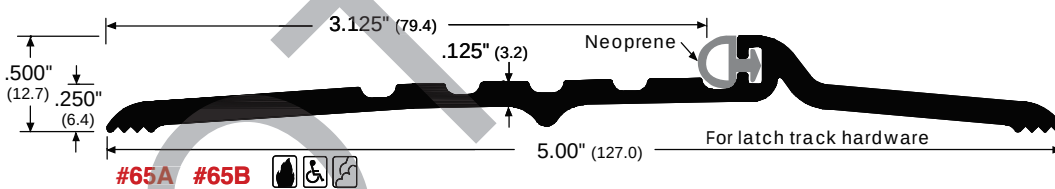
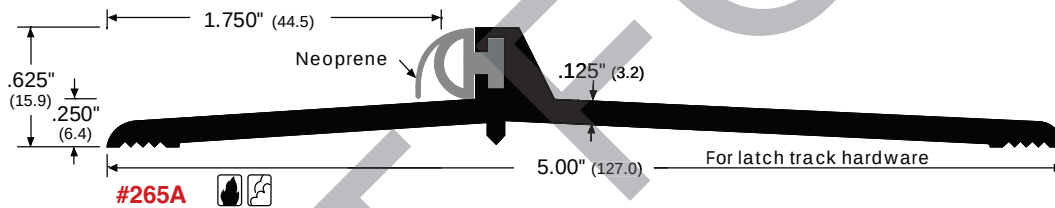
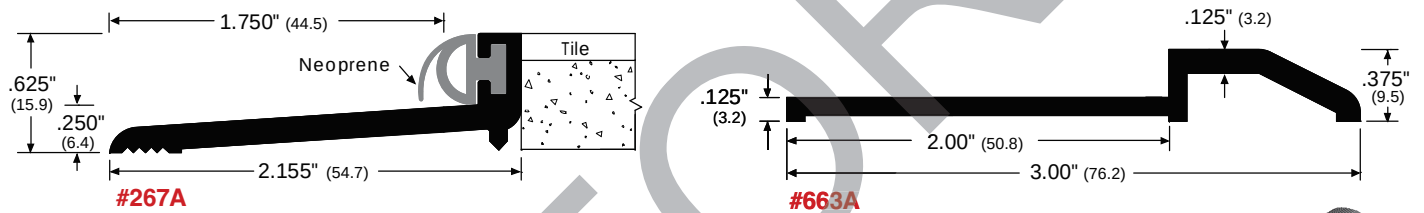
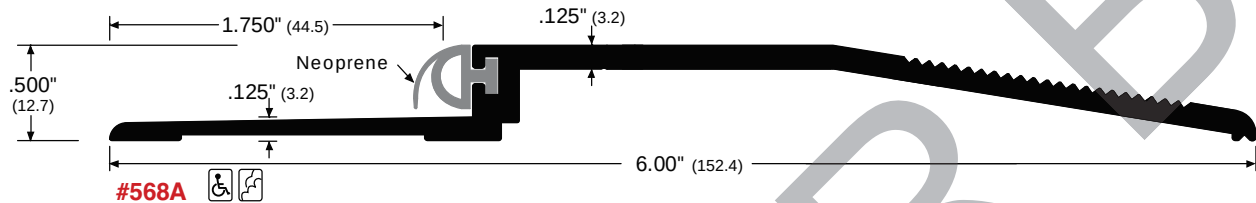
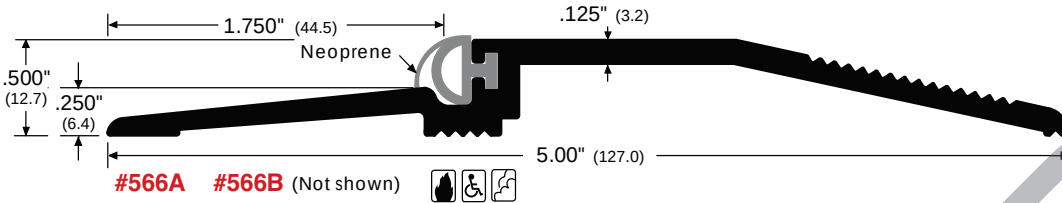
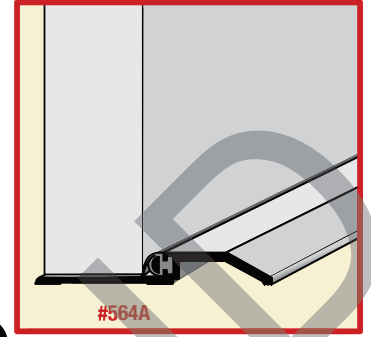
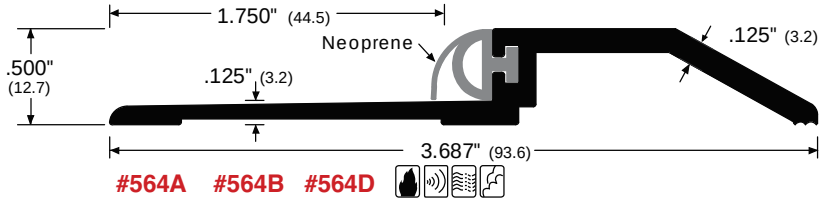
Note: A = Aluminum

B = Bronze

D = Dark Bronze Anodized

Thresholds can be ordered with E (Epoxy Abrasive), EL (Epoxy Abrasive Photoluminescent) or V3 (Full Body Strength) options.

Thresholds



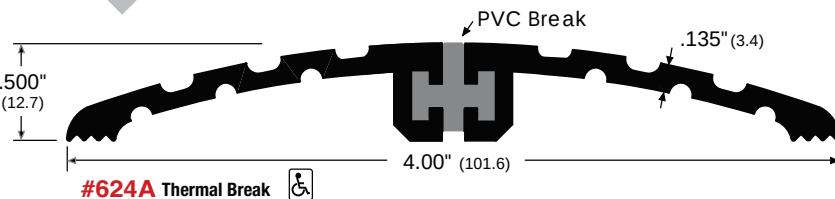
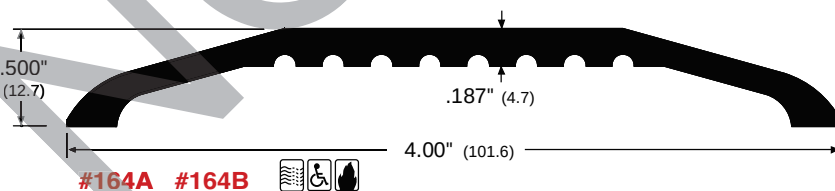
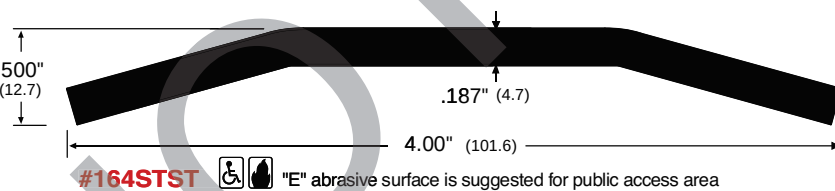
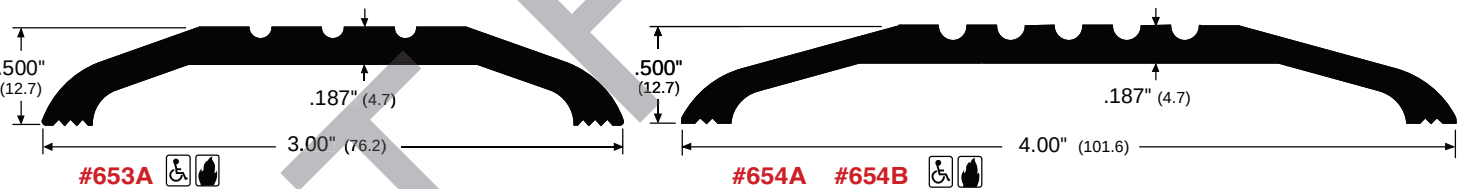
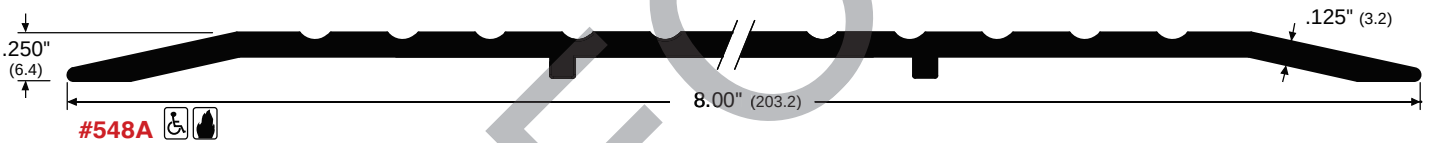
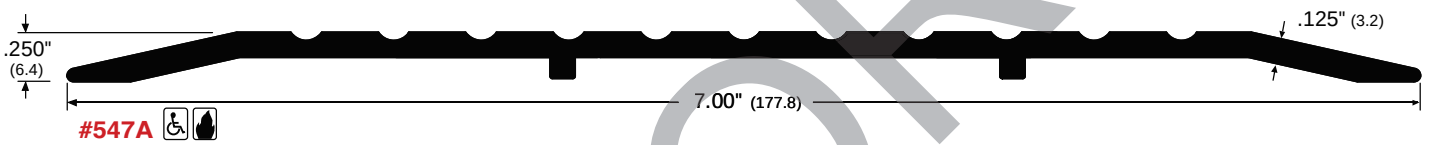
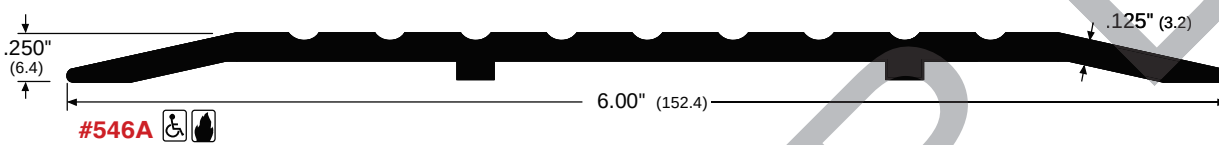
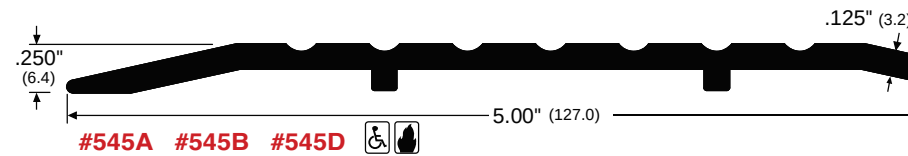
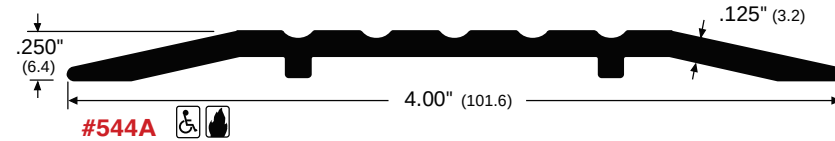
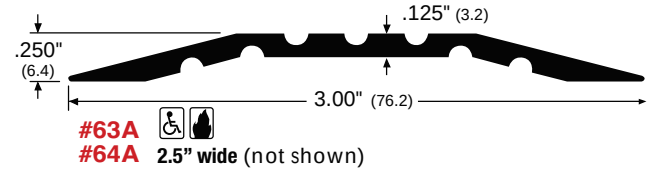
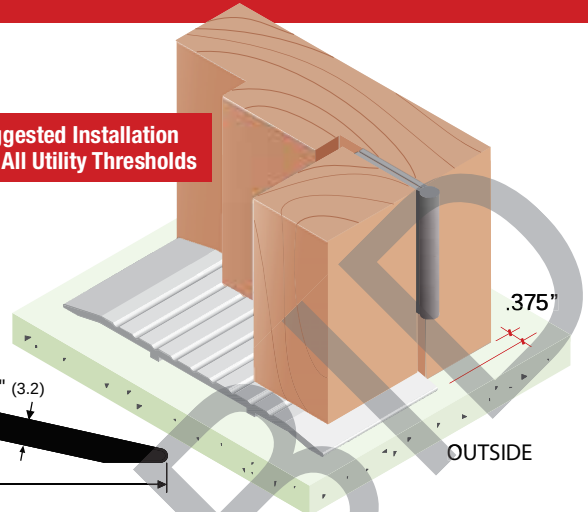
Utility Thresholds



Note: A = Aluminum B = Bronze
D = Dark Bronze Anodized STST = Stainless Steel
Thresholds can be ordered with E (Epoxy Abrasive), EL (Epoxy Abrasive Photoluminescent) or V3 (Full Body Strength) options.

Thresholds

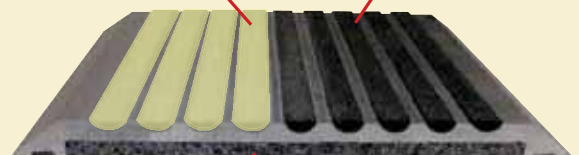
Suggested Installation
For All Utility Thresholds



OPTIONS:

■ **Non-Slip Epoxy Abrasive.** Thresholds can be ordered with non-slip epoxy abrasive particles bonded into the grooves. The tread provides a coefficient of friction of 1.02 dry and 0.98 wet to comply with ADA, OSHA and most local building code requirements. To order, add -E or -EL after the item number. Example : #657A-E or #657A-EL

EL - Epoxy Abrasive Photoluminescent **E - Epoxy Abrasive**



V3 - Full Body Strength

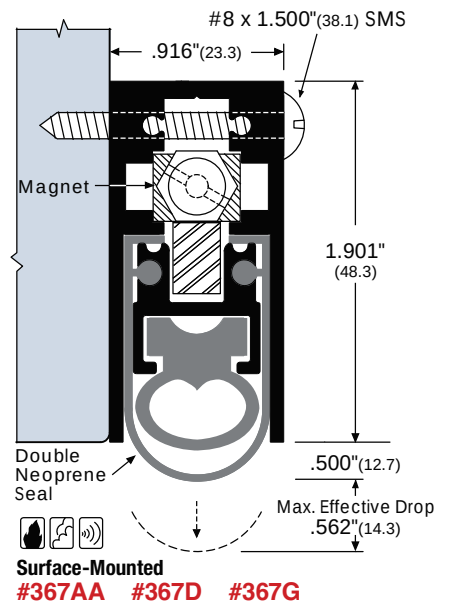
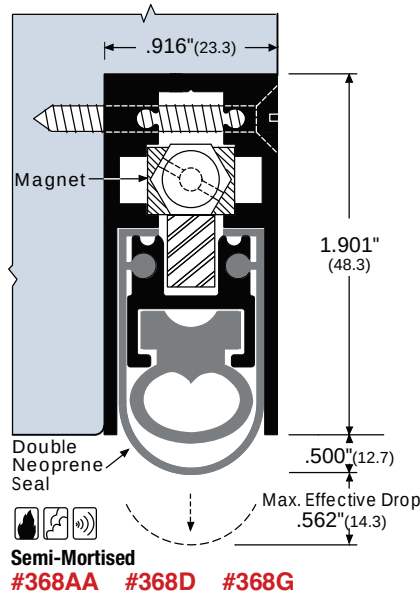
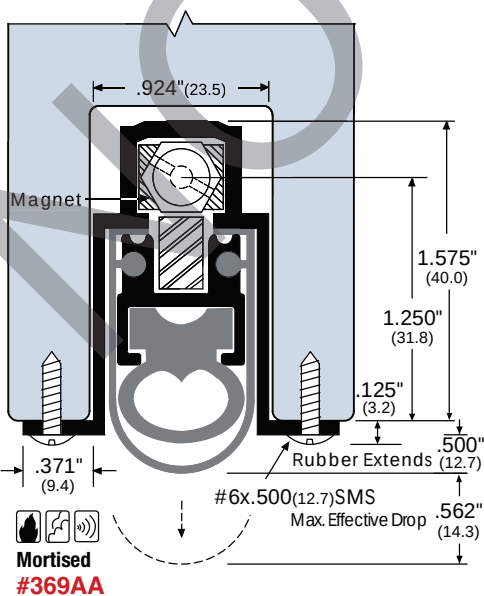
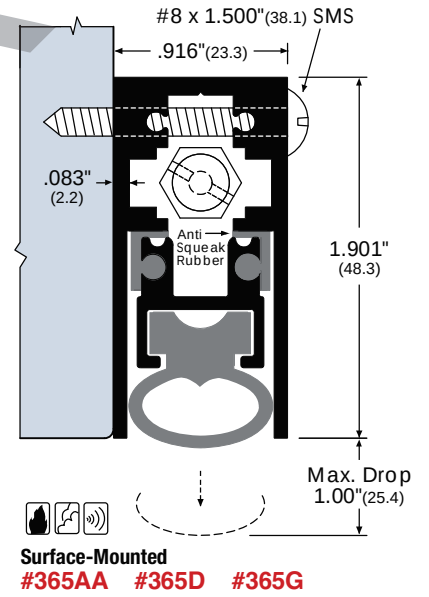
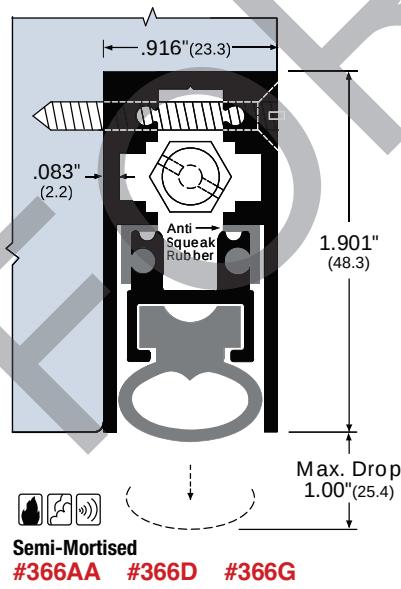
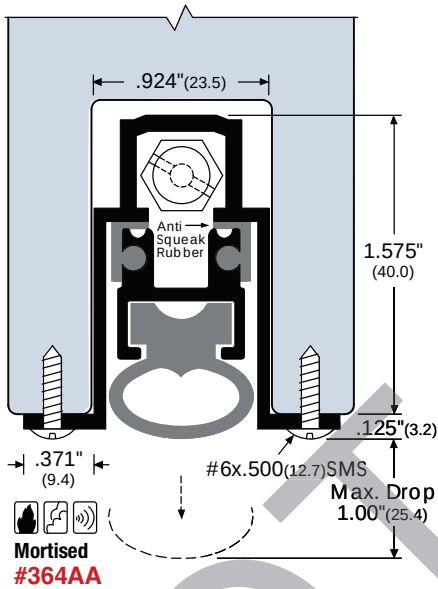
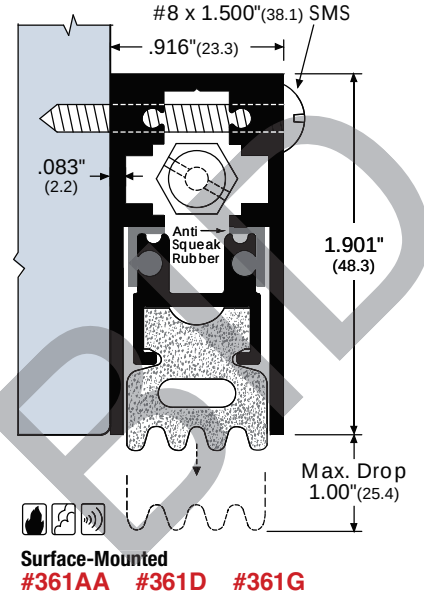
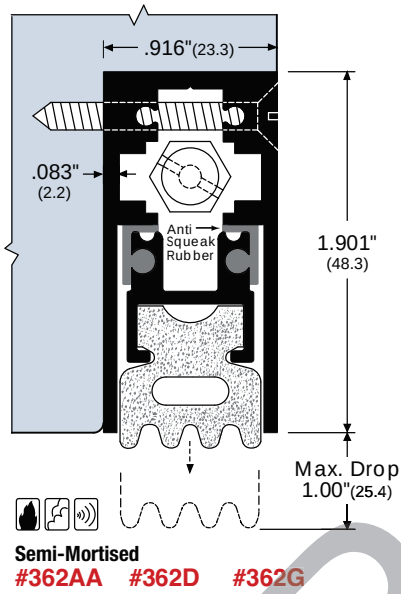
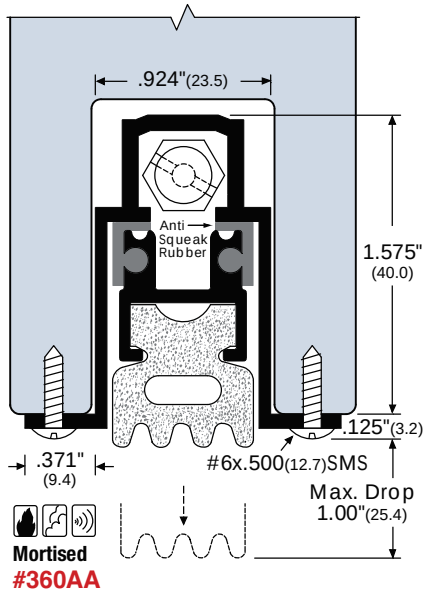
■ **Full Body Strength.** An aluminum composite filler containing aluminum oxide and silicone carbide. Ideal applications include heavy commercial traffic in supply rooms, manufacturing buildings, schools, cafeterias, automobile dealers, hospitals, industrial facilities. To order, add -V3 after the item number. Example: #657A-V3

Sill Protection Automatic Door Bottoms - Heavy Duty



Note: A = Aluminum
AA = Clear Anodized
D = Dark Bronze Anodized
G = Gold Anodized

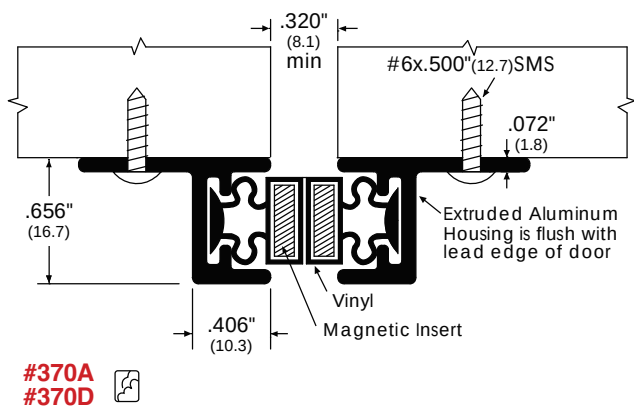
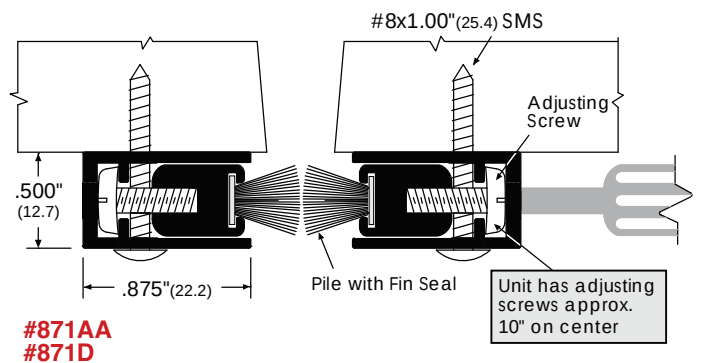
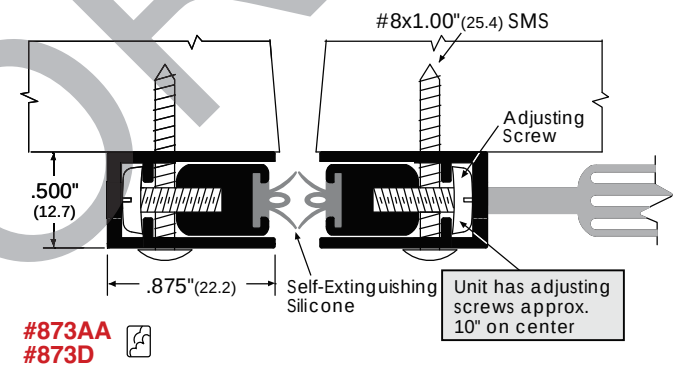
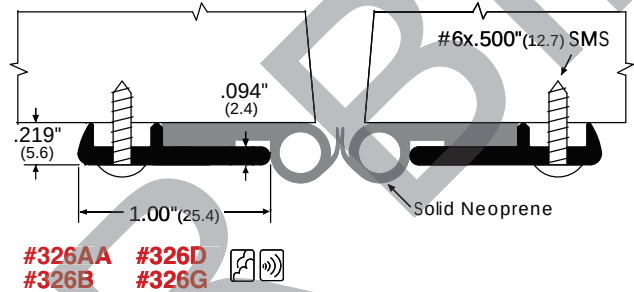
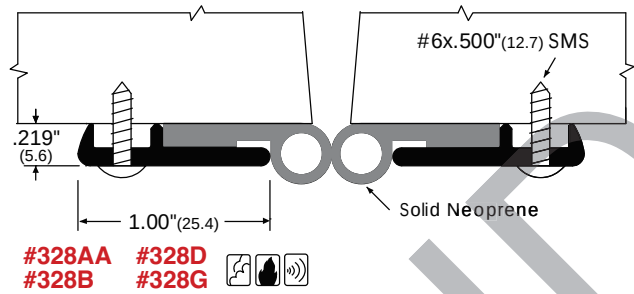
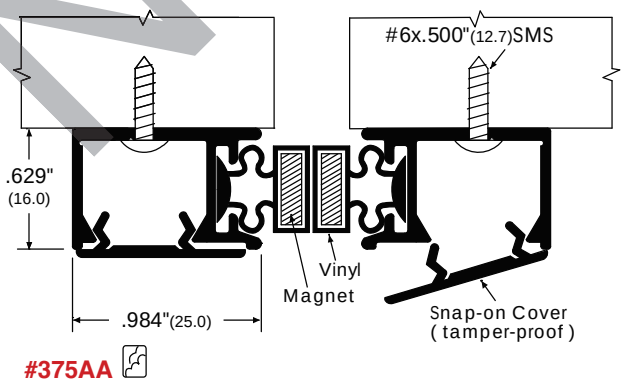
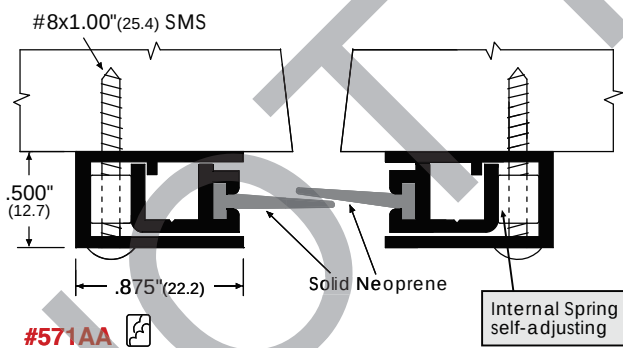
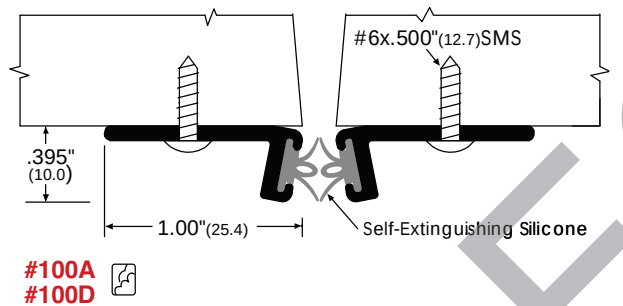
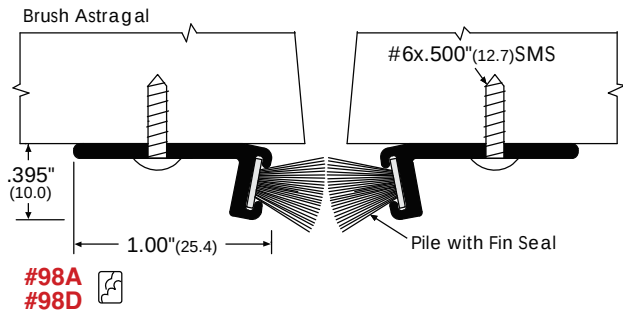
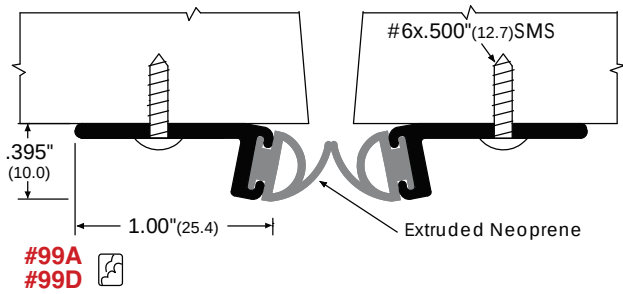
Door Bottoms



Meeting Stiles - Both Doors Active



Note: A = Aluminum
B = Bronze
G = Gold Anodized
AA = Clear Anodized
D = Dr. Bronze Anodized



FIRE PERFORMANCE

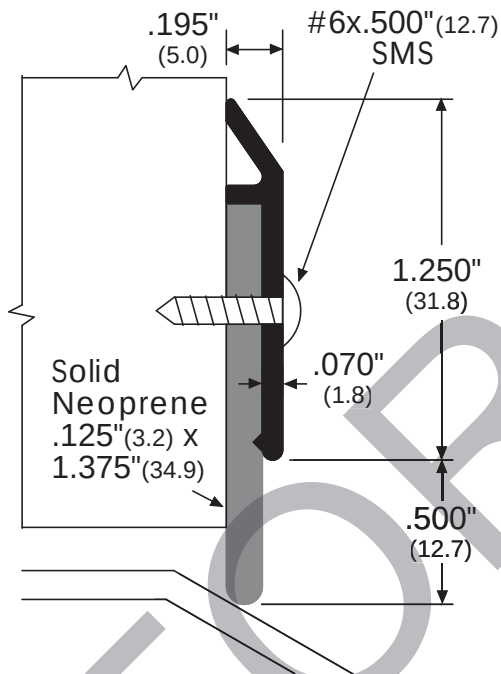


This seal is non-flammable

SMOKE PERFORMANCE



The rubber seal in this gasket provides protection from smoke infiltration in accordance with provisions of NFPA 101 Life Safety Code and NFPA 80 Standard for Fire Doors and Other Opening Protectives



Legend:

A = Aluminum
D = Dark Bronze Anodized

ANSI/BHMA

#39A / 39D

R3B434



415 Concord Avenue tel: 718.585.3230
Bronx, NY 10455 fax: 718.292.2243
email: zero@zerointernational.com
web site: www.zerointernational.com

Notes:

Part No:

39

Part Description:

Door Sweep

- Surface Mounted
Aluminum with Neoprene

Provided By:

Customer Name:

Job No:

Date:

SECTION 08800 - GLAZING

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 glazing for the following products, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Interior windows
- B. Related Sections include the following:
 - 1. Division 08 Section Mirrors
 - 2. Division 08 Aluminum Clad Wood Windows
 - 3. Division 08 Aluminum Clad Outswinging Doors

1.3 SYSTEM PERFORMANCE REQUIREMENTS:

- A. General: Provide glazing systems that are produced, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading (where applicable), without failure including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; and other defects in construction.

1.4 SUBMITTALS:

- A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each glass product and glazing material indicated.
- C. Product certificates signed by glazing materials manufacturers certifying that their products comply with specified requirements.

- D. Product test reports for each type of glazing sealant and gasket indicated, evidencing compliance with requirements specified.

1.5 QUALITY ASSURANCE:

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1 FGMA Publications: "FGMA Glazing Manual".
 - 2 SIGMA Publications: TM-3000 "Vertical Glazing Guidelines".
- B. Glazier Qualifications: Engage an experienced glazier who has completed glazing similar in material, design, and extent to that indicated for Project with a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING:

- A. Protect glazing materials to comply with manufacturer's directions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 PROJECT CONDITIONS:

- A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing materials manufacturer or when glazing channel substrates are wet from rain, condensation, or other causes.
 - 1. Install liquid sealants at ambient and substrate temperatures above 40 deg F (4.4 deg C).

1.9 DEFINITIONS

- A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

- C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.10 WARRANTY:

- A. Manufacturer's Warranty: Submit written warranty signed by manufacturer of glass agreeing to furnish replacements for glass units that deteriorate, f.o.b. point of manufacture, freight allowed Project site, within specified warranty period indicated below. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, protecting, and maintaining practices contrary to glass manufacturer's published instructions.
 - 1. Warranty Period: Manufacturer's standard but not less than 10 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRIMARY FLOAT GLASS PRODUCTS:

- A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), Class as indicated below, and Quality q3 (glazing select).
 - 1. Ultra-Clear (Low-Iron) Float Glass: Class I (clear); with a minimum 91 percent visible light transmission and a minimum solar heat gain coefficient of 0.87.

2. Available Products:
 - a. PPG Industries, Inc.; Starphire.

B. Heat Treated Float Glass:

1. Uncoated Clear, Heat-Treated Float glass: ASTM C 11048, Condition A (uncoated surfaces), Type 1 (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), kind as indicated below.

2.2 ELASTOMERIC GLAZING SEALANTS:

- A. General: Provide products of type indicated, complying with the following requirements:
1. Compatibility: Select glazing sealants and tapes of proven compatibility with other materials they will contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturer's recommendations for selecting glazing sealants and tapes that are suitable for applications indicated and conditions existing at time of installation.
 3. Elastomeric Glazing Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with ASTM C 920 requirements.

2.3 GLAZING TAPES:

- A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent, nonstaining and nonmigrating in contact with nonporous surfaces, with spacer rod as recommended by tape and glass manufacturers for application indicated, packaged on rolls with a release paper backing, and complying with AAMA 800.

2.4 MISCELLANEOUS GLAZING MATERIALS:

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials involved for glazing application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket

manufacturer.

- C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85 plus or minus .
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side-walking).
- F. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonextruding, nonoutgassing, strips of closed-cell plastic foam of density, size, and shape to control sealant depth and otherwise contribute to product optimum sealant performance.

2.5 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS:

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Examine glass framing, with glazier present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
 - 2. Presence and functioning of weep system.
 - 3. Minimum required face or edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
 - 5. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.2 PREPARATION:

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.3 GLAZING, GENERAL:

- A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.
- B. Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- C. Provide spacers for glass sizes larger than 50 united inches (length plus height) as follows:
 - 1. Locate spacers inside, outside, and directly opposite each other. Install correct size and spacing to preserve required face clearances, except where gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
 - 3. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.
 - 4. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.4 PROTECTION AND CLEANING:

- A. Protect exterior glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than

once a month, for build-up of dirt, scum, alkali deposits, or stains, and remove as recommended by glass manufacturer.

- D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents and vandalism, during construction period.
- E. Wash glass on both faces in each area of Project not more than 4 days prior to date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION 088000

NOT FOR BID

SECTION 089000 - LOUVERS, GRILLES AND VENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fixed-Blade Extruded-Aluminum Louvers:
 - 1. Horizontal drainable-blade louver.

1.2 RELATED SECTIONS

- A. Section 055000 - Metal Fabrications.
- B. Section 079200 - Joint Sealants.

1.3 REFERENCES

- A. Air Movement and Control Association International (AMCA):
 - 1. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating.
 - 2. AMCA 501 - Application Manual for Air Louvers.
 - 3. AMCA 511 - Certified Ratings Program - Product Rating Manual for Air Control Devices.
 - 4. AMCA 512 - AMCA Listing Label Program. Water and Air Certification.
 - 5. AMCA 512 - AMCA Listing Label Program. Water, Air, Wind-Driven Rain Certification.
 - 6. AMCA 512 - AMCA Listing Label Program. Water, Air, Sound Certification.
 - 7. AMCA 512 - AMCA Listing Label Program. Air Certification.
 - 8. AMCA 540 - Test Method for Louvers Impacted by Windborne Debris.
 - a. K6744X - AMCA 540 Basic Lev D.
 - b. K6746X - AMCA 540 Basic Lev D or Enhanced Level E.
 - c. K6746MD - AMCA 540 Basic Lev D or Enhanced Level E.
 - d. T9106X - AMCA 540 Enhanced Level E.
 - e. T9106MD - AMCA 540 Enhanced Level E.
 - f. SCH501X - AMCA 540 Enhanced Level E.
 - g. SCV602X - AMCA 540 Enhanced Level E.
 - h. K605MD - AMCA 540 Enhanced Level E.
 - i. SCV602X - AMCA 540 Enhanced Level E.
 - j. SCH601MD (w VCD-40) - AMCA 540 Enhanced Level E.
 - k. SCV602MD (w and w/o damper) - AMCA 540 Enhanced Level E.
 - l. SCV660MD - AMCA 540 Enhanced Level E.
 - m. SCH601MD - AMCA 540 Enhanced Level E.

9. AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers.
 - a. SCH601MD (w VCD-40) - AMCA 550.
 - b. SCV602MD (w and w/o damper) - AMCA 550.
 - c. SCV660MD - AMCA 550.
- B. ASTM International (ASTM):
 1. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 2. ASTM A 666 - Standard Specification for Annealed or Cold Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 3. ASTM A 788 - Standard Specification for Steel Forgings, General Requirements.
 4. ASTM B 26 - Standard Specification for Aluminum Alloy Sand Castings.
 5. ASTM B 209 - Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate.
 6. ASTM B 221 - Standard Specification for Aluminum and Aluminum Alloy Rolled or Cold Finished Bar, Rod, and Wire.
 7. ASTM C 578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
 8. ASTM C 612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 9. ASTM D822 - Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
 10. ASTM D 1187 - Standard Specification for Asphalt Base Emulsions for Use as Protective Coatings for Metal.
 11. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
 12. ASTM D2244 - Standard Test Method for Calculation of Color Differences From Instrumentally Measured Color Coordinates.
 13. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 14. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
 15. ASTM E 413 - Classification for Rating Sound Insulation.
- C. American Architectural Manufacturer's Association (AAMA).
 1. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
 2. AAMA 2603 - Voluntary Specification. Performance Requirements and Test Procedures For. Pigmented Organic Coatings on Aluminum Extrusions.
 3. AAMA 2604 - High Performance Organic Coatings on Architectural Extrusions and Panels.

4. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum.
- D. National Association of Architectural Metal Manufacturers (NAAMM): Metal Finishes Manual for Architectural and Metal Products.
- E. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): Architectural Sheet Metal Manual.
- F. National Electrical Manufacturers Association (NEMA).
- G. Underwriters Laboratories, Inc. (UL).

1.4 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. Standard Free Area: Free area of a louver 48 inches (1220 mm) wide by 48 inches (1220 mm) high, identical to that provided.
- C. Maximum Standard Airflow: Airflow at point of beginning water penetration through a louver 48 inches (1220 mm) wide by 48 inches (1220 mm) high, identical to that provided.
- D. Drainable-Blade Louver: Louver designed to collect and drain water to exterior at sill by means of gutters in front edges of blades and channels in jambs and mullions.
- E. Minimum Weather Louver Effectiveness: Weather louver effectiveness rating shall be based on tests conducted in accordance with:
 1. AMCA Standard 500-L.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets for each product and assembly specified.
 1. Preparation instructions and recommendations.
 2. Storage and handling requirements and recommendations.
 3. Cleaning methods.
- C. Engineering Review: Submit theoretical calculations prepared by a professional engineer specializing in the application of welding technology demonstrating that each fillet weld joining blade and frame members will withstand a minimum of 526 pounds of force in shear.

- D. Shop Drawings: For units and accessories. Include plans; elevations; sections; and details showing profiles, angles, and spacing of elements. Show unit dimensions related to wall openings and adjacent construction; free area for each size indicated for louvers; profiles of frames at jambs, heads, and sills; and anchorage details and locations.
1. Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.
 2. For installed products indicated to comply with design loadings, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 3. Wiring Diagrams: Detail power, signal, and control systems for motorized adjustable louvers and differentiate between manufacturer-installed and field-installed wiring.
- E. Product Certificates:
1. Air Performance: Certificates signed by Air Movement and Control Association International Inc (AMCA) certifying that the manufacturer's stock units are tested in accordance with AMCA Standard 500 and are licensed to bear the AMCA Certified Ratings Seal in accordance with AMCA Standard 511.
 2. Water Penetration: Certificates signed by Air Movement and Control Association International Inc (AMCA) certifying that the manufacturer's stock units are tested in accordance with AMCA Standard 500 and are licensed to bear the AMCA Certified Ratings Seal in accordance with AMCA Standard 511.
 3. Weather Louver Effectiveness: Certificates signed by Air Movement and Control Association International Inc (AMCA) certifying that the manufacturer's stock units are tested in accordance with AMCA Standard 500-L99, Section 8.3.2 - Wind Driven Rain Water Penetration Test, and are licensed to bear the AMCA Certified Ratings Seal in accordance with AMCA Standard 511.
 4. Provide AMCA Certification - Water, Air for louvers as scheduled.
 5. Provide AMCA Certification - Water, Air, Wind-Driven Rain for louvers as scheduled.
 6. Provide AMCA Certification - Water, Air, Sound for louvers as scheduled.
 7. Provide AMCA Certification - Air for louvers as scheduled.
- F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- G. Selection Samples: Two complete color charts showing the full range of colors available for units with factory-applied color finishes.
- H. Samples for Verification: For each finish specified, two samples representing actual finishes specified; prepared on Samples of same thickness and material indicated for final Work. Where finishes involve normal color and texture variations, include

Sample sets showing the full range of variations expected.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum 5 years manufacturing similar products. The manufacturer shall have implemented a program for the management of quality objectives, continual improvement, and monitoring of customer satisfaction to assure that customer needs and expectations are met.
- B. Installer Qualifications: Minimum 2 years experience installing similar louvers.
- C. Professional Engineer Qualifications: A professional engineer legally qualified to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of products that are similar to those indicated for this Project in material, design, and extent.
- D. Source Limitations: Obtain products through one source from a single manufacturer where alike in one or more respects regarding type, design, or factory-applied color finish.
- E. Welding Standards: As follows:
 - 1. Comply with AWS D1.2, "Structural Welding Code - Aluminum."
 - 2. Comply with AWS D1.3, "Structural Welding Code - Sheet Steel."
- F. AMCA Standard 500-L: Air performance, water penetration and air leakage ratings shall be determined in accordance with Air Movement and Control Association International Inc (AMCA) Standard 500, "Laboratory Methods of Testing Louvers for Rating."
- G. AMCA Standard 511: Air performance, water penetration and air leakage ratings shall be licensed in accordance with Air Movement and Control Association International Inc. (AMCA) Standard 511, "Certified Ratings Program for Air Control Devices," latest edition.
- H. AMCA Standard 512: Ratings shall be determined in accordance with Air Movement and Control Association International Inc (AMCA) Standard 512, "AMCA Listing Label Program," latest edition.
- I. SMACNA Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" recommendations for fabrication, construction details, and installation procedures.
- J. UL and NEMA Compliance: Provide motors and related components for motor-operated adjustable louvers that are listed and labeled by UL and comply with applicable NEMA standards.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards.
- B. Store products indoors in manufacturer's or fabricator's original containers and packaging, with labels clearly identifying product name and manufacturer. Protect from damage.
- C. Handling: Protect materials and finishes during handling and installation to prevent damage.

1.8 SEQUENCING AND SCHEDULING

- A. Field Measurements: Verify openings and adjacent construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.
 - 2. 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.

1.9 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 recommended limits.

1.10 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard limited warranty for louver systems for a period of 1 year from date of installation, no more than 18 months after shipment from manufacturing plant. When notified in writing from the Owner of a manufacturing defect, manufacturer shall promptly correct deficiencies without cost to the Owner.
- B. Manufacturer's Finish Warranty: Provide manufacturer's limited warranty for 70% fluoropolymer-based finish on aluminum substrates.
 - 1. Warranty Period: 10 years.
 - 2. Warranty Period: 20 years.

3. Finish coating shall not peel, blister, chip, crack or check.
 4. Chalking, fading or erosion of finish when measured by the following tests:
 - a. Finish coating shall not chalk in excess of 8 numerical ratings when measured in accordance with ASTM D4214.
 - b. Finish coating shall not change color or fade in excess of 5 NBS units as determined by ASTM D2244 and ASTM D822.
 - c. Finish coating shall not erode at a rate in excess of .01 mils/year confirmed by Florida test samples.
- C. Manufacturer shall provide 5 year limited warranty for 50% fluoropolymer-based finish on aluminum substrates.
1. Finish coating shall not peel, blister, chip, crack or check.
 2. Chalking, fading or erosion of finish when measured by the following tests:
 - a. Finish coating shall not chalk in excess of 8 numerical ratings when measured in accordance with ASTM D4214.
 - b. Finish coating shall not change color or fade in excess of 5 NBS units as determined by ASTM D2244 and ASTM D822.
 - c. Finish coating shall not erode at a rate in excess of .01 mils/year confirmed by Florida test samples.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Airolite Co. (The), which is located at: P.O. Box 410; Schofield, WI 54476; Tel: 715-841-8757; Fax: 715-841-8773; Email: [request info \(info@airolite.com\)](mailto:requestinfo@airolite.com); Web: www.airolite.com
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 LOUVERS, GRILLES AND VENTS - GENERAL.

- A. Louvers shall be mechanically fastened construction and furnished with bird screen, insect screen, sill pans, supports, installation hardware and finishes as specified or required for a complete installation.
- B. Louver shall be of welded construction and furnished with bird screen, insect screen, sill pans, supports, installation hardware and finishes as specified or required for a complete installation.

- C. The supporting structure shall be designed to accommodate the point loads transferred by the louvers when subject to the design wind loads.
- D. Performance Requirements:
1. Structural Performance: Provide products capable of withstanding the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of components including blades, frames, and supports; noise or metal fatigue caused by component rattle or flutter; or permanent damage to fasteners and anchors.
 - a. Wind Load: Uniform pressure (velocity pressure) of 25 lbf/sq. ft. (1200 Pa), acting inward or outward.
 - b. Thermal Movements: Provide products that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, and other detrimental effects:
 - c. Temperature Change (Range): 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.
 2. Air-Performance, Water-Penetration, and Air-Leakage Ratings: Provide louvers complying with performance requirements indicated, as demonstrated by testing manufacturer's stock units 48 inches (1220 mm) wide by 48 inches (1220 mm) high. Test units according to AMCA 500.
 - a. Perform testing on unpainted, cleaned, degreased units.
 - b. Perform water-penetration testing on louvers without screens.
 3. Airborne Sound Transmission Loss: Provide acoustical louvers complying with airborne sound transmission loss ratings indicated, as demonstrated by testing manufacturer's stock units according to ASTM E 90 and certified under AMCA standard 511.
 4. Weather Louver Effectiveness: Provide louvers complying with performance requirements indicated, as demonstrated by testing manufacturers stock units in accordance with AMCA Standard 500-L, Section 8.3.2 - Wind Driven Rain Water Penetration Test.
- E. Materials:
1. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T5 or T-52.
 2. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy 3003 or 5052 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
 3. Aluminum Castings: ASTM B 26/B 26M, alloy 319.
 4. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.
 - a. Use types and sizes to suit unit installation conditions.

5. Anchors and Inserts: Of type, size, and material required for loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as needed for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.
 6. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 but containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Fabrication:
1. Assemble units 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.
 - a. Continuous Vertical Assemblies: Where height of units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates and without interrupting blade-spacing, or grille or screen pattern.
 2. Maintain equal louver blade spacing to produce uniform appearance.
 3. Fabricate frames, including integral sills for louvers, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining materials' tolerances, and perimeter sealant joints.
 4. Include supports, anchorages, and accessories required for complete assembly.
 5. Louvers shall be of welded construction.
 6. Louvers shall be of mechanically fastened construction.

2.3 FIXED-BLADE EXTRUDED-ALUMINUM LOUVERS

- A. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
- B. Fixed-Blade Extruded-Aluminum Louvers: Horizontal Louvers as manufactured by The Airolite Co.
 1. Product: K609:
 - a. Depth: 4 inches (102 mm) nominal louver depth.
 - b. Type: Visible mullion.
 - c. Type: Concealed mullion.
 - d. Percent Free Area: 50%.
 - e. Beginning Point of Water Penetration: 602 fpm (3.06 m/s).
 - f. Air Volume Flow Rate at Beginning Point of Water Penetration: 4,761 cfm (2.25 m³/s).
 - g. Pressure Drop at Beginning Point of Water Penetration: 0.08 in. H₂O (0.020 kPa).
 - h. Blade Thickness: 0.081 in (2 mm) 0.125 in (3 mm).
 - i. Frame Thickness: 0.081 in (2 mm) 0.125 in (3 mm)

2.4 LOUVER SCREENS

- A. General: Provide louvers with screens as manufactured by The Airolite Co. at locations indicated on Drawings.
- B. General: Provide exterior louvers with louver screens.
 - 1. Screen Location for Fixed Louvers: Interior face.
 - 2. Screen Location for Adjustable Louvers: Interior face, unless otherwise indicated.
 - 3. Screen Location for Adjustable Louvers: Exterior face, unless otherwise indicated.
 - 4. Screening Type: Bird screening, unless otherwise indicated.
 - 5. Screening Type: Insect screening where indicated.
- C. Attachment: Secure screens to louver frames with stainless-steel machine screws, spaced 18 inches (458 mm) o.c.
- D. Louver Screen Frames: As manufactured by The Airolite Co; to sizes indicated on Drawings.
 - 1. Fabrication: Mitered corners.
 - 2. Metal: Roll formed aluminum.
 - 3. Finish: Same finish as louver frames to which louver screens are attached.
 - 4. Finish: Mill finish, unless otherwise indicated.
 - 5. Type: Rewirable frames with a driven spline or insert for securing screen mesh.
 - 6. Type: Non-rewirable, U-shaped frames for permanently securing screen mesh.
- E. Louver Screening for Aluminum Louvers: As manufactured by The Airolite Co.
 - 1. Bird Screening: Flattened, expanded aluminum, 3/4 by 0.050 inch (19 by 1.27 mm) thick.

2.5 BLANK-OFF PANELS

- A. General: Provide blank-off panels as manufactured by The Airolite Co. at locations indicated on Drawings.
 - 1. Attachment: Blank-off panels are not sealed, but fastened to the interior face of the louver.
 - 2. Attachment: Blank-off panels are silicone wet sealed and fastened to the interior face of the louver.
- B. Non-Insulating, Blank-off Panels: Metal sheet as manufactured by The Airolite Co.
 - 1. Aluminum Sheet for Aluminum Louvers:
 - a. 0.050 inch (1.2 mm) thickness, precoat black.
 - b. 0.063 inch (1.6 mm) thickness, finished to match exterior and/or interior.
 - c. 0.125 inch (3.2 mm) thickness, finished to match exterior and/or interior.

2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish units after assembly.

2.7 ALUMINUM FINISHES

- A. Compliance: Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
- B. High-Performance Organic Coating Finish: AA-C12C42R1x.
 - 1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Chemical Finishes: Cleaned with inhibited chemicals and acid-chromate-fluoride-phosphate conversion coating.
 - 3. Fluoropolymer Two-Coat Coating System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
 - a. Color: As selected by Architect from manufacturer's full range of colors to match Siding Trim Color.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Prepare substrates and openings using methods recommended by manufacturer for achieving best result for substrates under project conditions.
- B. Do not proceed with installation until substrates and nailers have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.
- C. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
 - 1. Locate and place units level, plumb, and at indicated alignment with adjacent

- work.
2. 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.
 3. Form closely fitted joints with exposed connections accurately located and secured.
 4. Provide perimeter reveals and openings of uniform width for sealants and joint fillers as indicated on Drawings.
 5. 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.
 6. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- B. Install concealed gaskets, flashings, joint fillers, and insulation, as installation progresses, where weathertight joints are required. Comply with Division 7 Section "Joint Sealants" for sealants applied during installation.

3.3 ADJUSTING, CLEANING AND PROTECTION

- A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
- B. Protect products from damage until completion of project. Use temporary protective coverings where needed and approved by manufacturer. Remove protective covering at the time of Substantial Completion.
- C. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 089000

SECTION 092100 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior gypsum board assemblies.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions.

1.3 RELATED SECTIONS

- A. Division 1 Specification Sections including, but not limited to Submittals.
- B. Division 6: Rough Carpentry Framing

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

1.5 QUALITY ASSURANCE

- A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 INTERIOR GYPSUM BOARD

- A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
1. 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:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Gypsum Co.
 - b. G-P Gypsum.
 - c. National Gypsum Company.
 - d. USG Corporation.
- B. Firecode Type X:
1. Thickness: 5/8" inch.
 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
 3. Use for all gypsum board walls at interior spaces. Provide moisture resistant green board at all Wet Plumbing walls in toilet rooms and above ceramic tile in Shower Stall.
- C. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
1. Thickness: 5/8 inch. Type "X"
 2. Long Edges: Tapered.
- D. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
1. Core: 5/8 inch, Type X.
 2. Long Edges: Tapered.
- E. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board. Provide in all Corridors.
1. Core: 5/8 inch (15.9 mm), Type X.
 2. Long Edges: Tapered.

2.2 Cementitious Backer Units: ANSI A118.9.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Custom Building Products; Wonderboard.
 - b. USG Corporation; DUROCK Cement Board.
3. Thickness: As indicated on Drawings, 5/8". Use in all Shower Stalls behind Ceramic tile and 5/8" Moisture- Resistant Type X above ceramic tile in Shower Stall.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - e. Expansion (control) joint.
 - f. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.
2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
 2. Exterior Gypsum Soffit Board: Paper.
 3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 4. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.
- D. Joint Compound for Tile Backing Panels:
1. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
 2. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
- D. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."
- E. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- D. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.

3.2 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations per the above schedule.

3.3 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
 - 1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
 - 2. Fasten with corrosion-resistant screws.

3.4 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners, unless otherwise indicated.
 - 2. LC-Bead: Use at exposed panel edges.

3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 4: All Drywall panel surfaces that will be exposed to view, unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in other Division 09 Sections.

3.6 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 092400 – PORTLAND CEMENT PLASTER

PART 1 – GENERAL

1.1 SECTION INCLUDES

Supply and installation of LaHabra® FastWall 300 with Cement Finish Stucco Assemblies.

1.2 RELATED SECTIONS

- A. Section 031000 - Cast-in-Place Concrete
- B. Section 042200 - Unit Masonry
- C. Section 061600 - Sheathing
- D. Section 072500 – Weather-Air Barriers
- E. Section 076200 - Sheet Metal Flashing and Trim
- F. Section 079200 - Joint Sealants
- G. Section 085500 – Aluminum-Clad Windows
- H. Section 092100 - Gypsum Board Assemblies

1.3 REFERENCES

- A. ASTM C578 - Specification for Preformed, Cellular Polystyrene Thermal Insulation
- B. ASTM C847 - Standard Specification for Metal Lath
- C. ASTM C897 - Standard Specification for Aggregate for Job-Mixed portland Cement-Based Plaster
- D. ASTM C926 - Standard Specification for Application of portland Cement-Based Plaster
- E. ASTM C933 - Standard Specification for Welded Wire Lath
- F. ASTM C1032 - Standard Specification for Woven Wire Plaster Base
- G. ASTM C1063 - Standard Specification for Installation of Lathing and Furring for portland Cement Based Plaster
- H. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials
- I. UUB 790A - Specification for Building Paper.

1.4 ASSEMBLY DESCRIPTION

- A. LaHabra® FastWall 300 Stucco Assembly: A code complying water resistive barrier, metal lath, LaHabra Fiber-47 Fastwall Scratch & Brown (LaHabra Fiber-47 Fastwall Scratch & Brown Concentrate or LaHabra Fiber-47 Fastwall Scratch & Brown Sanded) ($\frac{3}{4}$ in (19 mm)) and a cement finish coat.

B.

1.5 SUBMITTALS

- A. General: Submit Samples, Water Resistive Barrier Evaluation Reports and manufacturers product datasheets in accordance with Division 1 General Requirements Submittal Section.
- B. Samples: Submit samples for approval. Samples shall be of materials specified and of suitable size as required to accurately represent each color and texture used on project. Prepare each sample using same tools and techniques for actual project application. Maintain and make available, at job site, approved samples.
- C. Manufacturer's Warranty: Submit sample copies of Manufacturer's Warranty indicating Single Source Responsibility for Stucco Base coat, finish coat and optional primer, level coat and reinforcing mesh as specified.

1.6 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Shall have marketed stucco assemblies in United States for at least five years and shall have completed projects of same general scope and complexity.
 - 2. Applicator: Shall be experienced and competent in installation of stucco materials, and shall provide evidence of a minimum of 5 years experience in work similar to that required by this section.
- B. Functional Criteria:
 - 1. General: Stucco application shall be to vertical substrates or to substrates sloped for positive drainage according to ASTM C926. Substrates sloped for drainage shall have additional protection from weather exposure that might be harmful to coating performance.
 - 2. Performance Requirements of Coatings applied to Expanded polystyrene features: Must comply with ASTM E 2568 or ICC Acceptance Criteria AC 219 for EIFS.
- C. Substrate Conditions:
 - 1. Substrate materials and construction shall conform to the building code having jurisdiction.
 - 2. Substrates shall be sound, dry and free of dust, dirt, laitance, efflorescence and other harmful contaminants.
 - 3. Substrate Dimensional Tolerances: Flat with $\frac{1}{4}$ in (6.4 mm) within any 4 ft (1.22 m) radius.
 - 4. Maximum deflection of substrate system under positive or negative design loads shall not exceed L/360 of span.
- D. Expansion and Control Joints: Continuous expansion and control joints shall be installed at locations in accordance with ASTM C1063 and ASTM C926.

1. Substrate movement, and expansion and contraction of LaHabra FastWall 300 Stucco and adjacent materials shall be taken into account in design of expansion joints, with proper consideration given to sealant properties, installation conditions, temperature range, coefficients of expansion of materials, joint width to depth ratios, and other material factors. Minimum width of expansion joints shall be as specified by the designer or shown on the project drawings.
2. In accordance with ASTM C1063, expansion or control joints shall be installed in walls not more than 144 ft² (13.4 m²) in area, and not more than 100 ft² (9.3 m²) in area for all non-vertical applications. The distance between joints shall not exceed 18 ft (5.5 m) in either direction or a length-to-width ratio of 2-½ to 1.
3. For direct application to concrete or masonry, stucco joints are required only at control/expansion joints in the underlying concrete or masonry.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver LaHabra FastWall 300 Stucco Assembly products in original packaging with manufacturer's identification.
- B. Storage: Store LaHabra FastWall 300 Stucco Assembly products in dry location, off the ground, protected from moisture.

1.8 SITE / ENVIRONMENTAL CONDITIONS

- A. Substrate Temperature: Do not apply LaHabra products to substrates whose temperature are below 40°F (4.4°C) or contain frost or ice.
- B. Inclement Weather: Do not apply LaHabra products during inclement weather, unless appropriate protection is employed.
- C. Sunlight Exposure: Avoid, when possible, installation of the LaHabra products in direct sunlight. Application of LaHabra Finishes in direct sunlight in hot weather may adversely affect aesthetics.
- D. Do not apply stucco base coats or finishes if ambient temperature falls below 40°F (4°C) within 24 hours of application. Protect stucco from uneven and excessive evaporation during dry weather and strong blasts of dry air.
- E. Prior to installation, the wall shall be inspected for surface contamination, or other conditions that may adversely affect the performance of the LaHabra FastWall 300 Stucco Assembly, and shall be free of residual moisture.

1.9 COORDINATION AND SCHEDULING:

- A. Coordination: Coordinate LaHabra FastWall 300 Stucco Assembly installation with other construction operations.

1.10 WARRANTY

- A. Warranty: Upon request, at completion of installation, provide LaHabra Standard Limited Stucco Warranty.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Parex USA, Inc., 4125 E. La Palma Ave., Suite 250, Anaheim, CA 92807. Contact: Bret Bastain, Architectural Sales Rep, (562) 607-4305, bret.bastain@parexusa.com.
- B. Components: Obtain components manufactured by Parex USA of LaHabra FastWall 300 Stucco Assembly from authorized distributors. No substitutions or additions of other materials are permitted without prior written permission from Parex USA for this project.

2.2 MATERIALS

- A. Stucco Materials:
 - 1. LaHabra Fiber-47 Fastwall Scratch & Brown (3/4")
 - a. LaHabra Fiber-47 Fastwall Scratch & Brown Concentrate: A factory blended portland cement, fibers, hydrated lime and proprietary ingredients, cement scratch and brown coat mixed in the field with sand, conforming to ASTM C926.
- B. RECOMMENDED - LaHabra Acrylic Bonder & Admix: 100% acrylic admix emulsion for portland cement based products, to enhance curing, adhesion, freeze-thaw resistance and workability and/or as an acrylic polymer bonding agent for between a cementitious base and stucco finish coat.
- C. LaHabra Finish:
 - 1. Medium Dash Finish.

2.3 RELATED MATERIALS AND ACCESSORIES

- A. General: LaHabra FastWall 300 Stucco Assembly and its related materials shall conform to ASTM C926, this specification and LaHabra Product Data Sheets.
- B. Substrate Materials:
 - 1. Substrate shall be gypsum sheathing, cement board, fiberboard, plywood, OSB, concrete, concrete masonry or other sheathing allowed by the applicable building code.
 - 2. The sheathing shall be in compliance with the building code having

jurisdiction.

3. Refer to Related Sections for project requirements.
- C. Water Resistive Barriers:
 1. For non-wood based sheathing shall be either:
 - a. 1 layer asphalt-saturated felt complying with ASTM D226 Type I or UUB 790a
 - b. Lath with appropriate paper backing.
 - c. Other recognized equivalent.
 2. For wood based sheathing shall be either:
 - a. Grade D paper with a water resistance equal to or greater than 60 minutes, with an intervening nonwater-absorbing layer or drainage space.
 - b. Other recognized equivalent.
- D. Lath and Accessories: Conform to ASTM C847, ASTM C933, ASTM C1032 and ASTM C1063 and Appendix
 1. Accessories: Manufacturer's standard steel products with minimum G60 galvanizing unless otherwise indicated as rigid polyvinyl chloride (PVC plastic) or zinc alloy
 2. Metal Plaster Bases: Minimum 17 gauge stucco netting, 3.4 lb/yd² (1.8 kg/m²) expanded metal diamond lath, or welded wire lath, furred in accordance with applicable codes and standards.
 3. Weep Screeds: Foundation weep screed with minimum 3-½ inch vertical attachment flange.
- E. Expanded Polystyrene Features over LaHabra Fastwall 300 Stucco
 1. Adhesive and Base Coat
 - a. LaHabra Polybond: Modified portland cement adhesive and basecoat mixed with water, for exterior foam shapes, such as pop-outs, plant-ons, cornices and reveals
 2. Insulation Board
 - a. Produced and labeled under a third party quality program as required by applicable building code and produced by a manufacturer approved by Parex USA.
 - b. Shall conform to ASTM C578, ASTM E2430 Type I, and the Parex USA specification for Molded Expanded Polystyrene Insulation board.
 3. Reinforcing Mesh
 - a. Parex USA Standard Mesh: Weight 4.5 oz/yd² (153 g/m²) reinforcing mesh.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verify project site conditions under provisions of Division 01.
- B. Compliance: Comply with manufacturer's instructions for installation of LaHabra FastWall 300 Stucco Assembly.
- C. Substrate Examination: Examine prior to LaHabra FastWall 300 Stucco Assembly installation as follows:
 - 1. Substrate shall be of a type approved by Parex USA. Plywood and OSB substrates shall be gapped $\frac{1}{8}$ in (3.2 mm) at all edges.
 - 2. Substrate shall be examined for soundness, and other harmful conditions.
 - 3. Substrate shall be free of dust, dirt, laitance, efflorescence, and other harmful contaminants.
 - 4. Substrate construction in accordance with substrate material manufacturer's specifications and applicable building codes.
- D. Advise Contractor of discrepancies preventing installation of the LaHabra FastWall 300 Stucco Assembly. Do not proceed with the LaHabra FastWall 300 Stucco Assembly work until unsatisfactory conditions are corrected.
- E. Ensure that flashing has been installed per Specification Section 07 60 00 - Flashing and Sheet Metal.

3.2 PREPARATION

- A. Water Resistive Barrier:
 - 1. The Water Resistive Barrier is placed over all substrates except concrete or unpainted masonry. Painted (coated) CMU requires the use a bond breaker such as asphalt paper and lath if the paint or coating cannot be removed.
 - 2. Installed according to manufacturers instructions.
- B. Wire Fabric Lath and Metal Lath: Install according to ASTM C1063 and Appendix and the Building Code.
- C. Concrete (Cast-in-Place): Provide a surface that is slightly scarified, water absorbent, straight and true to line and plane. Remove form ties and trim projecting concrete so it is even with the plane of the wall. Remove form release agents.
- D. Concrete Masonry Units: Remove projecting joint mortar so it is flush with the plane of the wall. Remove surface contaminants such as efflorescence, existing paint or any other bond inhibiting material by sandblasting, waterblasting, wire brushing, chipping or other appropriate means. Pre-moisten the surface with water just prior to placement of stucco, or apply one uniform coat of bonding agent by low pressure sprayer, brush or roller.

3.3 MIXING

- A. Mix LaHabra proprietary products in accordance with manufacturer's instructions, including the applicable LaHabra FastWall 300 Stucco Assembly Product Data Sheets.
- B. Admix – LaHabra Acrylic Bonder & Admix
 - 1. Mix up to 1 gallon per 90 pound bag of LaHabra Fiber-47 Fastwall Scratch & Brown Concentrate and up to 1 quart per 80 pound bag of LaHabra Fiber-47 Fastwall Scratch & Brown Sanded. Add after dry components and the majority of the water has been mixed. Mix no longer than required to provide a uniform mixture. DO NOT OVER-MIX. Overmixing entrains excessive amounts of air which weaken the material. Do not re-temper mixes over 20 minutes old.

3.4 APPLICATION

- A. General: LaHabra FastWall 300 Stucco Assembly and its related materials shall conform to ASTM C926, this specification and LaHabra Product Data Sheets.
- B. Bonding Agent - LaHabra Acrylic Bonder & Admix
 - 1. Apply at the approximate rate of 250 sq. ft. per gallon using a low-pressure sprayer, brush or roller. (Application in direct sunlight may cause the product to dry too quickly).
 - 2. Stucco products should be applied after LaHabra Acrylic Bonder becomes tacky up to 72 hours after application, but not while wet.
- C. LaHabra Fiber-47 Fastwall 300 Scratch and Brown:
 - 1. Scratch Coat:
 - a. Apply scratch coat to a minimum thickness of $\frac{3}{8}$ in (9.5 mm), using sufficient trowel pressure to key stucco into lath or to create bond to substrates as applicable.
 - b. Prior to initial set, scratch horizontally to provide key for bond of brown coat.
 - c. Moist cure scratch coat with clean potable water for at least 48 hours in accordance with ASTM C926 and the building codes following initial application (unless brown coat is applied as soon as the scratch coat has achieved sufficient rigidity to support the brown coat).
 - 2. Brown Coat:
 - a. Apply brown coat to a minimum thickness of $\frac{3}{8}$ in (9.5 mm), using sufficient trowel pressure to key stucco into scratch coat.
 - b. Rod surface to true plane and float to densify.
 - c. Moist cure brown coat with clean potable water for at least 48 hours, in accordance with ASTM C926 and the building codes.

D. Cement Finish Coat:

1. Apply Stucco Finish according to product datasheet and application instructions.
2. Protect LaHabra Finish Coats from inclement weather until completely dry and cured.

G. Curing:

1. LaHabra Fastwall Stucco Base: Keep stucco moist for at least 48 hours (longer in dry weather) by lightly fogging walls. Start light fogging after initial set of 1–2 hours.

3.5 CLEAN-UP

- A. Removal: Remove and legally dispose of Armourwall 300 Stucco component debris material from job site.

3.6 PROTECTION

- A. Provide protection of installed materials from water infiltration into or behind them.
- B. Provide protection of installed stucco from dust, dirt, precipitation, and freezing during installation.
- C. Provide protection of installed finish from dust, dirt, precipitation, freezing and continuous high humidity until fully cured and dry.
- D. Clean exposed surfaces using materials and methods recommended by the manufacturer of the material or product being cleaned. Remove and replace work that cannot be cleaned to the satisfaction of the Project Designer/Owner.

END OF SECTION 092400

SECTION 093000 - TILING

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 this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Ceramic Tile Floor and walls
 - 2. Marble Thresholds at Toilet Rooms and similar areas.
 - 3. Metal Edge Strips installed at Tile and Carpet transitions.
 - 4. Crack-suppression membrane for thin-set tile installations.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for monolithic slab finishes specified for tile substrates.
 - 2. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.3 DEFINITIONS

- A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.
- B. Facial Dimension: Actual tile size (minor facial dimension as measured per ASTM C 499).
- C. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.4 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum 0.6.
2. Step Treads: Minimum 0.6.
3. Ramp Surfaces: Minimum 0.8.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.
- D. Samples for Verification:
 1. Full-size units of each type and composition of tile and for each color and finish required.
 2. Assembled samples with grouted joints for each type and composition of tile and for each color and finish required, at least 12 inches (300 mm) square and mounted on rigid panel. Use grout of type and in color or colors approved for completed work.
 3. Full-size units of each type of trim and accessory for each color and finish required.
 4. Stone thresholds in 6-inch (150-mm) lengths.
- E. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- F. Product Certificates: For each type of product, signed by product manufacturer.
- G. Qualification Data: For Installer.
- H. Material Test Reports: For each tile-setting and -grouting product.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain all tile of same type and color or finish tile of same type tile of same color or finish from one source or producer.
 1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
 - 1. thresholds.
 - 2. Joint sealants.
 - 3. Metal edge strips.
- D. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
 - 1. Build mockup of each type of floor tile installation.
 - 2. Build mockup of each type of wall tile installation.
 - 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Store liquid latexes and emulsion adhesives in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.9 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. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Basis-of-Design Product: The design for each tile type is based on the product named on the drawings.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
 - 2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.

- C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
 - 1. As selected by Architect from manufacturer's full range.
- D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.
 - 1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.
- F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 TILE PRODUCTS

- A. Manufacturers:
 - 1. Daltile "Dignitary" Colorbody Porcelain Tile. Floor Tile: DR09 "Notable Beige". Wall Tile: DR07 "Luminary White". Provide S36C9T 6 inch x 12 inch Cove Base in Floor Tile color and provide S-43F9 3 inch x 24 inch Bullnose at Wall Tile Wainscot. See Plans for Tile Details.

2.4 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - 1. Bevel edges at 1:2 slope, aligning lower edge of bevel with adjacent floor finish. Limit height of bevel to 1/2 inch (12.7 mm) or less, and finish bevel to match face of threshold.
- B. Marble Thresholds: ASTM C 503 with a minimum abrasion resistance of 12 per ASTM C 1353 or ASTM C 241 and with honed finish. Color as selected by Architect.

2.5 CRACK-SUPPRESSION AND WATERPROOF MEMBRANES FOR THIN-SET TILE INSTALLATIONS

- A. General: Manufacturer's standard product that complies with ANSI A118.10 and ASTM C627, selected from the following.
- B. Fabric-Reinforced, Fluid-Applied Product: System consisting of liquid-latex rubber and fabric reinforcement.
 - 1. Available Products:
 - a. NobleSeal TS Waterproofing by Noble Company.

2.6 SETTING AND GROUTING MATERIALS

- A. Available Manufacturers:
 - 1. Atlas Minerals & Chemicals, Inc.
 - 2. Bonsal, W. R., Company.
 - 3. Bostik.
 - 4. Custom Building Products.
 - 5. DAP, Inc.
 - 6. LATICRETE International Inc.
 - 7. MAPEI Corporation.
 - 8. Latex Additive: Manufacturer's standard acrylic resin water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
- B. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.
 - 1. For wall applications, provide non-sagging mortar that complies with Paragraph C-4.6.1 in addition to the other requirements in ANSI A118.1.
- C. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:
 - 1. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added at Project site.
 - 2. Prepackaged dry-mortar mix combined with acrylic resin liquid-latex additive.
 - a. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.

- D. Medium-Bed, Latex-Portland Cement Mortar: Provide materials composed as follows, with physical properties equaling or exceeding those required for thin-set mortars based on testing of medium-bed specimens according to ANSI A118.4:
1. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added at Project site.
 2. Prepackaged dry-mortar mix combined with acrylic resin liquid-latex additive.
- E. Organic Adhesive: ANSI A136.1, Type I, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.
- G. Standard Sanded Cement Grout: ANSI A118.6, color as indicated.
- H. Standard Unsanded Cement Grout: ANSI A118.6, color as indicated.
- I. Polymer-Modified Tile Grout: ANSI A118.7, color as indicated.
1. Polymer Type: Ethylene vinyl acetate, in dry, redispersible form, prepackaged with other dry ingredients.
 2. Polymer Type: Acrylic resin in liquid-latex form for addition to prepackaged dry-grout mix.
 3. Polymer Type: Either ethylene vinyl acetate, in dry, redispersible form, prepackaged with other dry ingredients, or acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
 - a. Unsanded grout mixture for joints 1/8 inch (3.2 mm) and narrower.
 - b. Sanded grout mixture for joints 1/8 inch (3.2 mm) and wider.

2.7 ELASTOMERIC SEALANTS

- A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 07 Section "Joint Sealants."
1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.
- C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other

nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

1. Available Products:

- a. Dow Corning Corporation; Dow Corning 786.
- b. GE Silicones; Sanitary 1700.
- c. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
- d. Tremco, Inc.; Tremsil 600 White.

2.8 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
 1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
 2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- D. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.
 1. Available Products:
 - a. Bonsal, W. R., Company; Grout Sealer.
 - b. Bostik; CeramaSeal Grout Sealer.
 - c. C-Cure; Penetrating Sealer 978.
 - d. Custom Building Products; Surfaceguard Sealer.
 - e. MAPEI Corporation; KER 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.
 - f. TEC Specialty Products Inc.; TA-256 Penetrating Silicone Grout Sealer.

2.9 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
 - 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
 - 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.
- B. Provide concrete substrates for tile floors installed with adhesives or thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.

1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
 2. Remove protrusions, bumps, and ridges by sanding or grinding.
- C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- D. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
- F. Lay out tile wainscots to next full tile beyond dimensions indicated.

- G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
1. Locate joints in tile surfaces directly above joints in concrete substrates.
 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- H. Grout tile to comply with requirements of the following tile installation standards:
1. For ceramic tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex-portland cement grouts), comply with ANSI A108.10.
 2. For chemical-resistant epoxy grouts, comply with ANSI A108.6.
 3. For chemical-resistant furan grouts, comply with ANSI A108.8.
- I. At showers, tubs, and where indicated, install cementitious backer units and treat joints to comply with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.4 CRACK-SUPPRESSION/ WATERPROOFING MEMBRANE INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.
- B. Install crack-suppression membrane to comply with manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.
- C. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 FLOOR TILE INSTALLATION

- A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.
1. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.
 - a. Exterior tile floors.
 - b. Tile floors in wet areas.
 - c. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
 - d. Tile floors composed of rib-backed tiles.

- B. Joint Widths: Install tile on floors with the following joint widths:
1. Ceramic Floor Tile: Manufacturer's recommendation or indicated on plans.
 2. Quarry Tile: 1/4 inch (6.35 mm).
 3. Paver Tile: 1/4 inch (6.35 mm).
- C. Stone Thresholds: Install thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated.
1. Set thresholds in latex-portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent nontile floor finish.
- D. Grout Sealer: Apply grout sealer to cementitious grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

3.6 WALL TILE INSTALLATION

- A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.
- B. Joint Widths: Install tile on walls with the following joint widths:
1. Glazed Wall Tile: Manufacturers recommendation.
 2. Quarry Tile: 1/4 inch (6.35 mm).

3.7 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
1. Remove latex-portland cement grout residue from tile as soon as possible.
 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

- B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.8 FLOOR TILE INSTALLATION SCHEDULE

- A. Tile Installation: Interior floor installation on crack-suppression membrane over concrete; thin-set mortar; TCA F122 and ANSI A108.5.
 - 1. Tile Type: Colorbody Porcelain tile.
 - 2. Thin-Set Mortar: Latex-Portland cement mortar.
 - 3. Grout: Polymer-modified sanded and unsanded grout.

3.9 WALL TILE INSTALLATION SCHEDULE

- A. Tile Installation: Interior wall installation over water-resistant gypsum board thin-set mortar; TCA W243 and ANSI A108.5.
 - 1. Tile Type: Colorbody Porcelain wall tile
 - 2. Thin-Set Mortar: Latex- portland cement mortar.
 - 3. Grout: Polymer-modified sanded and Polymer-modified unsanded grout.
- B. Tile Installation: Interior wall installation over cementitious backer units; thin-set mortar; TCA W244 and ANSI A108.5.
 - 1. Tile Type: Colorbody Porcelain wall tile.
 - 2. Thin-Set Mortar: Latex- Portland cement mortar.
 - 3. Grout: Polymer-modified unsanded grout.

END OF SECTION 093000

NOT FOR BID

SECTION 093100 - SHEET MEMBRANE WATERPROOFING AND CRACK ISOLATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sheet membrane waterproofing for tile and dimension stone installations.
 - a. Sheet membrane bonded to tile substrate with NobleBond EXT or latex Portland cement mortar, thin-set mortar for shower floors and walls.
2. Sheet membrane crack isolation for tile and dimension stone installations.
 - a. Sheet membrane bonded to tile substrate with latex Portland cement mortar for floors.
 - b. Sheet membrane bonded to tile substrate with adhesive for floors.

1.2 REFERENCES

- A. ANSI A108.13 - Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone.
- B. ANSI A108.17 - Installation of Crack Isolation Membranes.
- C. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.
- D. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.
- E. ASTM E 96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
- F. ASTM F 1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
- G. ASTM F 2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
- H. TCNA Handbook - TCNA Handbook for Ceramic, Glass, and Stone Tile Installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For each specified product provide Shop Drawings and details.
 - 1. Include details sheet membrane waterproofing installation, with flashings and terminations.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SHEET MEMBRANE WATERPROOFING AND CRACK ISOLATION

- A. Sheet Membrane: ANSI A118.10; composite sheet membrane made from an alloy of non-plasticized chlorinated polyethylene (CPE) with non woven fiber laminated to both sides.
 - 1. Basis of Design Manufacturer: Noble Company.
 - 2. Basis of Design Product: NobleSeal TS.
- B. Performance:
 - 1. Crack Isolation: "High performance" rating when tested to the "System Crack Resistance" portion of ANSI A118.12.

2.2 ACCESSORIES

- A. Bonding Mortar:
 - 1. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
- B. Bonding Adhesive: Type recommended by sheet membrane manufacturer to suit application with VOC less than LEED allowable limits.
 - 1. Basis of Design Product: NobleBond EXT.
 - 2. Basis of Design Product: NobleBond 21.
- C. Mortar Bed:
 - 1. Portland Cement Mortar (Thickset): ANSI A108.02.
- D. Seam Sealant: Type recommended by sheet membrane manufacturer with VOC less than LEED allowable limits.
- E. Perimeter Sealant: Type recommended by sheet membrane manufacturer with VOC less than LEED allowable limits.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine tile and stone substrates, including walls, floors, and framing for unacceptable conditions affecting sheet membrane installation.
- B. Examine roughing-in for plumbing piping to verify actual locations of piping connections before sheet membrane installation.
- C. Correct unacceptable conditions before installing sheet membrane.

3.2 PREPARATION

- A. Examine, prepare, and test concrete floors for finish flooring installation in accordance with ASTM F 710. Perform one moisture emission test in accordance with ASTM F 1869 relative humidity test in accordance with ASTM F 2170 and one alkalinity test for every 2,000 sf. Obtain instructions corrective measures from flooring and adhesive manufacturers when test results are not within specified limits.
 - 1. Surface Tolerance: Maximum variation from plane of 3/16 inch in 10 feet.
 - a. Floor systems over which tile will be installed shall be in conformance with applicable building codes.
- B. When tested moisture emission rate exceeds specified maximum, consult membrane manufacturer, thin-set manufacturer and tile manufacturer for acceptable mitigation methods and materials.

3.3 INSTALLATION - SHEET MEMBRANE WATERPROOFING AND VAPOR RETARDER

- A. Comply with ANSI A108.13, TCNA Handbook, and the manufacturers instructions for installation of sheet membrane waterproofing.
- B. Bonded Installation for Thin-Set Applications:
 - 1. Apply bonding mortar or adhesive for full coverage of substrate.
 - 2. Install sheet membrane and fully embed into bonding material.
 - a. A carpet type roller may be used to embed sheet membrane on horizontal surfaces.
 - b. Hand roller or flat side of trowel can be used to embed sheet membrane on vertical surfaces.
- C. Overlap sheets minimum 2 inches shingle fashion in direction of water drainage. Seal joints watertight.
- D. Turn sheet membrane installed on floors up vertical surfaces minimum 2 inches higher than flood plane and bond to substrate.

1. Shower Walls: When sheet membrane is turned up and terminated behind backer board, extend minimum 3 inches above flood plane and fasten to substrate with no penetrations less than 2 inches above flood plane.
- E. Extend sheet membrane into floor drains. Cut drain opening in sheet membrane and seal to drain body. Secure membrane with floor drain clamping ring.
- F. Seal sheet membrane watertight to items penetrating sheet membrane.

3.4 INSTALLATION - SHEET MEMBRANE CRACK ISOLATION

- A. Comply with ANSI A108.17, TCNA Handbook, and the manufacturers instructions for installation of sheet membrane waterproofing.
- B. Apply bonding mortar or adhesive for full coverage of substrate.
- C. Install sheet membrane and fully embed into bonding material.

3.5 FIELD QUALITY CONTROL

- A. Upon completion of sheet membrane waterproofing installation, plug drains, dam perimeter of waterproofing and fill with water minimum 2 inches deep and maintain for 24 hours.
 1. Inspect waterproofing for leaks.
 2. Repair leaks and re-test until watertight.
- B. Prepare test and inspection reports. Indicate corrective measures required to make installation watertight.

3.6 PROTECTION

- A. Protect sheet membrane from pedestrian and vehicular traffic and prolonged exposure to sunlight.
- B. Keep sheet membrane clean until tile finishes are installed.

END OF SECTION 093100

SECTION 09 50 00 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

1.2 SUMMARY

A. Section Includes

1. Acoustical Ceiling Panels
2. Exposed grid suspension system
3. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings
4. Perimeter Trim

B. Related Selections

1. Section 092000 - Gypsum Board
5. Division 01 - Removal and Salvage of Construction Materials
6. Divisions 23 - HVAC Air Distribution
7. Division 26 - Electrical

C. Alternates

1. **Prior Approval:** Unless otherwise provided for in the Contract documents, proposed product substitutions may be submitted no later than TEN (10) working days prior to the date established for receipt of bids. Acceptability of a proposed substitution is contingent upon the Architect's review of the proposal for acceptability and approved products will be set forth by the Addenda. If included in a Bid are substitute products that have not been approved by Addenda, the specified products shall be provided without additional compensation.
2. Submittals that do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified in Section 1.5); Underwriters' Laboratories Classified Acoustical performance; Panel design, size, composition, color, and finish; Suspension system component profiles and sizes; Compliance with the referenced standards.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
2. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
3. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
4. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
5. ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
6. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
7. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
8. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
9. ASTM E 119 Standard Test Methods for Fire Tests of Building Construction and Material.

B. Armstrong Fire Guard Products

10. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint.
11. ASTM E 1111 Standard Test Method for Measuring the Interzone Attenuation of Ceilings Systems.
12. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.
13. ASTM E 1264 Classification for Acoustical Ceiling Products

B. International Building Code

C. ASHRAE Standard 62.1-2004, Ventilation for Acceptable Indoor Air Quality

D. NFPA 70 National Electrical Code

E. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings.

F. International Code Council-Evaluation Services - AC 156 Acceptance Criteria for
.....Seismic Qualification Testing of Non-structural Components.

- G. International Code Council-Evaluation Services Report - Seismic Engineer Report
 - 1. ESR 1308 - Armstrong Suspension Systems.
- H. International Association of Plumbing and Mechanical Officials - Seismic Engineer Report
 - 1. 0244 - Armstrong Single Span Suspension System
- I. California Department of Public Health CDPH/EHLB Emission Standard Method
.....Version 1.1 2010
- J. LEED - Leadership in Energy and Environmental Design is a set of rating systems for
.....the design, construction, operation, and maintenance of green buildings

1.4 SYSTEM DESCRIPTION

- A. Continuous/Wall-to-Wall

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data for each type of acoustical ceiling unit and suspension system required.
- B. Samples: Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.
- C. Shop Drawings: Layout and details of acoustical ceilings show locations of items that are to be coordinated with, or supported by the ceilings.
- D. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.
- E. If the material supplied by the acoustical subcontractor does not have an Underwriter's Laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the architect's or owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

1.6 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.
 - 1. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
 - 2. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 Classification.
 - 3. Fire Resistance: As follows tested per ASTM E119 and listed in the appropriate floor or roof design in the Underwriters Laboratories Fire Resistance Directory
- B. Acoustical Panels: As with other architectural features located at the ceiling, may obstruct or skew the planned fire sprinkler water distribution pattern through possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.
- C. Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.8 PROJECT CONDITIONS

- A. Space Enclosure:

HumiGuard Plus Ceilings: Building areas to receive ceilings shall be free of construction dust and debris. Products with HumiGuard Plus performance and hot dipped galvanized steel, aluminum or stainless steel suspension systems can be installed up to 120°F (49°C) and in spaces before the building is enclosed, where

HVAC systems are cycled or not operating. Cannot be used in exterior applications where standing water is present or where moisture will come in direct contact with the ceiling.

1.9 ALTERNATE CONSTRUCTION WASTE DISPOSAL

- A. Ceiling material being reclaimed must be kept dry and free from debris
- B. Contact the Armstrong Recycle Center a consultant will verify the condition of the . . . material and that it meets the Armstrong requirements for recycling. The Armstrong . . . consultant with provide assistance to facilitate the recycling of the ceiling.

1.10 WARRANTY

- A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are . . . not limited to the following:
 - 1. Acoustical Panels: Sagging and warping
 - 2. Grid System: Rusting and manufacturer's defects
- B. Warranty Period:
 - 1. Acoustical panels: Ten (10) years from date of substantial completion.
 - 2. Grid: Ten (10) years from date of substantial completion.
 - 3. Acoustical panels and grid systems with HumiGuard Plus or HumiGuard Max . . . performance supplied by one source manufacturer is Thirty (30) years from date of . . . substantial completion.
- C. The Warranty shall not deprive the Owner of other rights the Owner may have under . . . other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of . . . the Contract Documents.

1.11 MAINTENANCE

- A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described . . below that match products installed. Packaged with protective covering for storage . . . and identified with appropriate labels.
 - 1. Acoustical Ceiling Units: Furnish quality of full-size units equal to 5.0 percent of . . amount installed.

2. Exposed Suspension System Components: Furnish quantity of each exposed . . .
suspension component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Ceiling Panels:
1. Armstrong World Industries, Inc.
- B. Suspension Systems:
1. Armstrong World Industries, Inc.
- C: Perimeter Systems
1. Armstrong World Industries, Inc.

2.2 ACOUSTICAL CEILING UNITS

- A. Acoustical Panels Type AP
1. Surface Texture: Fine
2. Composition: Mineral Fiber
3. Color: White
4. Size: 24IN x 24IN x 3/4" IN
5. Edge Profile: Beveled Tegalur 9/16IN
6. Noise Reduction Coefficient(NRC): ASTM C 423; Classified with UL label on . . .
product carton 0.60.
7. Ceiling Attenuation Class (CAC) : ASTM C 1414; Classified with UL label on product
carton 40.
8. Sabin: N/A
9. Articulation Class (AC):
10. Flame Spread: ASTM E 1264; Class A (UL)

11. Light Reflectance White Panel: ASTM E 1477; 0.90
12. Recycle Content: Post-Consumer - 1% Pre-Consumer Waste - 55%
13. Acceptable Product: Ultima Lay-In and Tegular, 1912 as manufactured by Armstrong World Industries.
14. Acceptable Suspension Grid: Suprafine XL 9/16" Exposed Tee Heavy Duty.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not proceed with installation until all wet work such as concrete, terrazzo, ... plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations. (Exception: HumiGuard Max . . Ceilings)

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical units to balance border . . widths at opposite edges of each ceiling. Avoid use of less than half width units at . . borders, and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.
- B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
 1. Furnish concrete inserts and similar devices to other trades for installation well in . advance of time needed for coordination of other work.

3.3 INSTALLATION

- A. Follow manufacturer installation instructions.
- B. Install suspension system and panels in accordance with the manufacturer's instructions, and in compliance with ASTM C 636 and with the authorities having jurisdiction.
- C. Suspend main beam from overhead construction with hanger wires spaced 4'-0" on . . . center along the length of the main runner. Install hanger wires plumb and straight.
- D. Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter . . corners where wall moldings intersect or install corner caps.

- E. For reveal edge panels: Cut and reveal or rabbet edges of ceiling panels at border . . .
. areas and vertical surfaces.
- F. Install acoustical panels in coordination with suspended system, with edges resting on .
. flanges of main runner and cross tees. Cut and fit panels neatly against abutting . .
. surfaces. Support edges by wall moldings.

3.4 ADJUSTING AND CLEANING

- A. Replace damaged and broken panels.
- B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and . .
. suspension members. Comply with manufacturer's instructions for cleaning and touch
. up of minor finish damage. Remove any ceiling products that cannot be successfully .
. cleaned and or repaired. Replace with attic stock or new product to eliminate evidence
. of damage.
- C. Before disposing of ceilings, contact the Armstrong Recycling Center at 877-276-7876,
. select option #1 then #8 to review with a consultant the condition and location of . .
. building where the ceilings will be removed. The consultant will verify the condition of .
. the material and that it meets the Armstrong requirements for recycling. The
. . . Armstrong consultant with provide assistance to facilitate the recycle of the ceiling.

END OF SECTION 095113

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 GENERAL

1.1 THIS SECTION INCLUDES

- A. Flooring and accessories as shown on the drawings and schedules and as indicated by the requirements of this section.

1.2 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract (including General and Supplementary Conditions and Division 1 sections) apply to the work of this section.

1.3 RELATED SECTIONS

- A. Other Division 9 sections for floor finishes related to this section but not the work of this section.
- B. Division 3 Concrete; not the work of this section.
- C. Division 6 Wood and Plastics; not the work of this section.
- D. Division 7 Thermal and Moisture Protection; not the work of this section.

1.4 QUALITY ASSURANCE AND REGULATORY REQUIREMENTS

- A. Select an installer who is competent in the installation of Armstrong resilient tile flooring.
- B. If required, provide types of flooring and accessories supplied by one manufacturer, including leveling and patching compounds, and adhesives.
- C. If required, provide flooring material to meet the following fire test performance criteria as tested by a recognized independent testing laboratory:
 - 1. ASTM E 648 Critical Radiant Flux of 0.45 watts per sq. cm. or greater, Class I.
 - 2. ASTM E 662 (Smoke Generation) Maximum Specific Optical Density of 450 or less.

1.5 SUBMITTALS

- A. Submit shop drawings, seaming plan, coving details, and manufacturer's technical data, installation and maintenance instructions (latest edition of "Armstrong Guaranteed Installation System," F-5061) for flooring and accessories.
- B. Submit the manufacturer's standard samples showing the required colors for flooring and applicable accessories.
- C. If required, submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required fire tests.

1.6 ENVIRONMENTAL CONDITIONS

- A. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.
- B. Store materials in a clean, dry, enclosed space off the ground, and protected from the weather and from extremes of heat and cold. Protect adhesives from freezing. Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.
- C. Maintain a minimum temperature in the spaces to receive the flooring and accessories of 65°F (18°C) and a maximum temperature of 100°F (38°C) for at least 48 hours before, during, and for not less than 48 hours after installation. Thereafter, maintain a minimum temperature of 55°F (13°C) in areas where work is completed. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances.
- D. Install flooring and accessories after the other finishing operations, including painting, have been completed. Close spaces to traffic during the installation of the flooring. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture tests.

PART 2 PRODUCTS

2.1 RESILIENT TILE FLOORING MATERIALS

- A. Provide Imperial® Texture Standard EXCELON® Tile Flooring manufactured by Armstrong World Industries, Inc., in color selected from the full range currently

available from Armstrong World Industries, Inc., having a nominal total thickness of 1/8"/0.125in. (3.2mm), 12 in. x 12 in. (305 mm x 305 mm), composed of polyvinyl chloride resin binder, plasticizers, fillers, and pigments with colors and texture dispersed uniformly throughout its thickness. Vinyl composition tile shall conform to the requirements of ASTM F 1066, Class 2 – through pattern. Locations of Tile shall be as shown on the Drawings.

- B. Provide Engineered Luxury Vinyl Waterproof Plank Flooring, "Engage Genesis 2000" as manufactured by Metroflor where shown on the plans. Color shall be 4173 WP "Sassafras", 15-year warranty. The Distributor is Tri-West Ltd., 12005 E. Pike St., Santa Fe Springs, CA 90670, Attn: Steve Friedman, Cell: (714) 604-7423. Email: sfriedman@trivestltd.com

2.2 WALL BASE MATERIALS

- A. Provide 0.080 in. (2.0 mm) thick, 4 in. (10.16 cm) high Burke Mercer Color-Integrated Wall Base with a matte finish, conforming to ASTM F 1861, Type TP - Rubber, Thermoplastic, Group 1 - Solid, Style B – Cove in color No. 203 Beige in Administration Wing and Medical wing and where shown on the drawings. Note: The Residential Wing will have Wood Base specified elsewhere

2.3 ADHESIVES

- A. For Tile Installation System, Full Spread: Provide Armstrong S-515 Resilient Tile Adhesive under the tile and Armstrong S-725 Wall Base Adhesive at the wall base as recommended by the flooring manufacturer.

2.4 ACCESSORIES

- A. For patching, smoothing, and leveling monolithic subfloors (concrete, terrazzo, quarry tile, ceramic tile, and certain metals), provide Armstrong S-183 Fast-Setting Cement-Based Underlayment.
- C. For sealing joints between the top of wall base or integral cove cap and irregular wall surfaces such as masonry, provide plastic filler applied according to the manufacturer's recommendations.
- D. Provide transition/reducing strips tapered to meet abutting materials.
 - 1. Provide threshold of thickness and width as shown on the drawings.
 - 2. Provide resilient edge strips of width shown on the drawings, of equal gauge to the flooring, homogeneous vinyl or rubber composition, tapered or bullnose edge, with color to match or contrast with the flooring, or as selected by the Architect from standard colors available.

3. Provide metal edge strips of width shown on the drawings and of required thickness to protect exposed edges of the flooring. Provide units of maximum available length to minimize the number of joints. Use butt-type metal edge strips for concealed anchorage, or overlap-type metal edge strips for exposed anchorage. Unless otherwise shown, provide strips made of extruded aluminum with a mill finish.

PART 3 EXECUTION

3.1 INSPECTION

- A. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.
- B. Inspect subfloors prior to installation to determine that surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
- C. Report conditions contrary to contract requirements that would prevent a proper installation. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- D. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

3.2 PREPARATION

- A. Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects with Armstrong S-183 Fast-Setting Cement-Based Underlayment as recommended by the flooring manufacturer.
- B. Remove paint, varnish, oils, release agents, sealers, and waxes. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents.
- C. For Tile Installation System, Full Spread or for Tile Installation System, Tile On , perform subfloor moisture testing in accordance with ASTM F 2170, "Standard Test Method for Determining Relative Humidity in Concrete Slabs Using *in-situ* Probes" ASTM F 1869, "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride" and Bond Tests as

described in publication F-5061, "Armstrong Guaranteed Installation System," to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. Relative humidity shall not exceed 80%. MVER shall not exceed 5 lbs./1000 sq. ft./24 hrs. On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained.

- D. Perform pH tests on concrete floors regardless of their age or grade level. All test results shall be documented and retained
- E. Vacuum or broom-clean surfaces to be covered immediately before the application of flooring. Make subfloor free from dust, dirt, grease, and all foreign materials.

3.3 INSTALLATION OF TILE FLOORING

- A. Install flooring in strict accordance with the latest edition of "Armstrong Guaranteed Installation System", F-5061 and Paradigm Installation System
- B. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.
- C. If required, install flooring on pan-type floor access covers. Maintain continuity of color and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.
- D. Scribe, cut, and fit to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.
- E. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.

3.5 INSTALLATION OF METROFLOR ENGAGE GENESIS 2000 PLANKS

- A. Follow manufacturers installation of the flooring product.

3.5 INSTALLATION OF ACCESSORIES

- A. Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top-set base is required. Install base in lengths as long as practical, with inside corners fabricated from base materials that are mitered or coped. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.
- B. Fill voids with plastic filler along the top edge of the resilient wall base or integral cove cap on masonry surfaces or other similar irregular substrates.

- C. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by the edge strip manufacturer. Install edge strips at edges of flooring that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Perform initial maintenance according to the latest edition of "Armstrong Guaranteed Installation System," F-5061.
- B. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings. (See Finishing The Job in "Armstrong Guaranteed Installation System," F-5061.)

END OF SECTION 096519

SECTION 096813 – MODULAR TILE CARPETING

PART 1: GENERAL

1.1 SECTION INCLUDES:

- A. Manufacturers
- B. Testing Protocols
- C. Performance Requirements
- D. Product Specifications
- E. Environmental Requirements
- F. Warranties
- G. Exclusions
- H. Installation
- I. Maintenance
- J. Accessories

1.2 REFERENCES

A. American Association of Textile Chemists and Colorists (AATCC):

- 1. AATCC 16 – Test Method for Colorfastness to Light
- 2. AATCC 107 – Test Method for Colorfastness to Water
- 3. AATCC 129 Test Method for Colorfastness to Ozone in the Atmosphere under High Humidity.
- 4. AATCC 134 – Test Method for Electrostatic Propensity of Carpets.
- 5. AATCC 165 –(93) Test Method for Colorfastness to Crocking: Carpets – AATCC Crock Meter Method
- 6. AATCC 175-(98) Test Method for stain Resistance: Pile Floor Coverings

B. American Society for Testing and Materials (ASTM):

- 1. ASTM D418-(12), Methods for Testing Pile Yarn Floor Covering Construction (Finished Pile Thickness only)
- 2. ASTM E648 – Test Method for Critical Radiant Flux of Floor Covering Systems using a Radiant Heat Energy Source.
- 3. ASTM E662 – Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
- 4. ASTM D3676 – Test Method for Thickness
- 5. ASTM D3676 – Test Method for Compression Resistance

7. ASTM D3676 – Test Method for Volume Density.
8. ASTM D3676 – Test Method for Compression Set.

C. International Standards Organization (ISO):

1. ISO 2551 – Test Method for Dimensional Stability (Aachen Test)

D. Carpet and Rug Institute (CRI):

1. CRI Indoor Air Quality Testing and Labeling Program

E. U.S. Department of Housing and Urban Development (HUD):

1. HUD UM 44D-(93), HUD Building Product Standards and Certification Program for Carpet.

1.3 PERFORMANCE REQUIREMENTS

A. Comply with the following performance requirements:

1. Radiant Panel: ASTM E648: >.45 watts/sq. cm: Class 1
2. Smoke Density: ASTM E662: 450 Flaming Mode - Maximum
3. Static Generation: AATCC 134: 3.5 KV - Maximum
4. Lightfastness: AATCC 16E: Min 4.0 at 40 hrs.
5. Crocking: AATCC 165: 4.0 – Wet/Dry
6. Cold Water Bleed: AATCC 107: 3.0 - Minimum
7. Ozone Fade: AATCC 129: 3.0 - Minimum
8. Soil Protection: AATCC 189: 500 PPM Min.
9. CRI Green Label Plus Air Quality Certification: Pass
10. CRI Appearance Retention Rating 3.0 minimum – Heavy Traffic
11. 3.5 minimum – Severe Traffic
12. Aachen Test: ISO 2551 Less than .15% shrinkage or growth
13. Stain protection: AATCC 175: Equal to or greater than 8.0 on Red 40 stain test.

B. Comply with the following Construction performance requirements:

1. Delamination: Pass 50,000 cycles roll stool test
2. Compression Resistance Test: 7.5 lb/sq. in. minimum
3. Compression Set: 10% Maximum

4. Elongation: 60% Minimum
5. Tensile Strength: 50 lb/ sq. in. minimum
6. Moisture Barrier-non seam area: Passes British Spill Test

C. Special Performance Requirements

1. Must have Soil and Stain Resist treatment
2. Must have minimum 20 dpf fiber
3. Must have Trilobal cross-section
4. Must have permanent anti-stat yarn.
5. Must be type 6 fiber

1.4 SUBMITTALS

A. Manufacturer's Data

1. Submit two (2) copies of manufacturer's specifications and installation instructions for modular carpet and related items specified.

B. Fiber Requirements

1. Submit certification from the fiber producer verifying the following:
 - a. Use of the specified fiber in the submitted carpet product.

C. Warranties

1. Submit warranties as described in Section 1.13

D. Maintenance

1. Maintenance Manual – submit manual of carpet manufacturer's recommendations for the general care, cleaning and maintenance of modular carpet products.

E. Certificate of Compliance

1. Submit certified test reports that modular carpet meets all the performance requirements stated above in section 1.3 Performance requirements. Submit certified test reports from a NVLAP Certified Lab that carpet meets all performance criteria.

F. Shop Drawings

1. For carpeted areas submit shop drawings showing installation of carpeting, pattern direction, necessary installation accessories, and provisions for work of other trades. Show location of different patterns or styles of modular carpet. Also show locations of any threshold conditions
2. The contractor will supply reproducible prints on request, to facilitate shop drawing preparation.

G. Samples

1. Submit standard-size modular carpet samples of each type of carpet, in each specified pattern, color and construction.
2. Any alternates to specified products must be submitted for approval by a representative of the end user or architect/design firm at least ten (10) working days prior to bid or proposal.
3. Final Sample Submittal
 - a. Submit two (2) sets of samples for each carpet type.
4. No carpet shipments are permitted until acceptance of final samples is given by representative of the end user or architect/design firm, certifying that samples are the approved color, pattern and texture.
5. Custom Color only
 - a. A representative of the end user or architect/design firm, certifying that the samples are the approved color, pattern and texture, shall sign high quality color samples.
6. Samples submitted are assumed to be the manufacturer's best obtainable match to the color described under Materials Section.
7. Must have federally registered Branded trademark.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data

1. Include maintenance procedures, recommended cleaning and stain removal materials, and recommended cleaning schedule. Include product data and Material Safety data Sheets (MSDS) for cleaning and stain-removal materials.

B. Installation Instructions

1. Include detailed installation procedures. Include modular installation procedures, adhesive types, trowel sizes, spread rates, open times, and Material Safety data sheets (MSDS) for all modular adhesives.

C. Warranties and Performance Certifications

Submit written warranties for all products as well as Performance testing results on all items included in Warranty section (including all testing results mandated by EverSet warranty on EverSet products) and Performance section of this specification.

1.6 QUALITY ASSURANCE

A. Single Source Responsibility: Provide products from a single manufacturer.

1. Warranties must be standard and not job specific.
2. All styles must come from the same manufacturer.
3. Must be single source fiber extrusion and yarn manufacturing.

1.7 QUALIFICATIONS

A. Manufacturer

1. Company specializing in manufacturing modular tiles with minimum five (5) years (documented) experience.

B. Installer/Flooring Contractor Qualifications

1. Carpet contractor must provide all the necessary licenses, performance bonds, and insurance certificates that comply with all local, state, and federal laws, ordinances, or codes prior to the start of the installation.
2. Carpet contractor shall be a firm established not less than five (5) years and, if requested, shall submit evidence of having furnished and installed commercial carpet with vinyl backings on commercial carpet projects of similar size and scope for at least give (5) years.

3. Flooring Contractor to provide references at the request of the owner.
4. Carpet Contractors must also be mill certified for installing products.
5. Carpet Contractor will be responsible for the proper product installation, including floor preparation, in those areas indicated in the Drawings.
6. Carpet Contractor to provide owner a written warranty that guarantees the completed installation be free from defects in materials and workmanship for a period of two (2) years after job completion.

1.8 PRE-INSTALLATION MEETINGS

- A. Convene one (1) week prior to commencing work of this section.
- B. Require attendance of (manufacturer), (installer), (contractor), (owner), (architect) and other parties directly affecting the work of this section.

1.9 DELIVERY, STORAGE AND HANDLING

1. Deliver modular carpet in sealed protective boxes and accessories in sealed containers. Segregate each modular product (if several product styles are involved), according to style, color, pattern, dye lot, run number, and quantity.
2. Store products in an enclosed and dry area protected from damage and soiling.

1.10 SITE ENVIRONMENTAL REQUIREMENTS

1. Do not install modular carpet until all areas have been fully enclosed and the environmental conditions have reached the levels desired for occupancy of the space.
2. Maintain ambient temperature and humidity conditions during and after installation of modular carpet at occupancy levels.
3. Allow modular carpet to reach room temperature, or minimum temperature recommended by manufacturer prior to the start of the installation.
4. Protect adhesives from freezing. Follow manufacturer's recommendations for minimum temperatures to which adhesives are exposed.

1.11 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on drawings.

1.12 SEQUENCING

- A. Sequence installation so as to minimize possibility of damage and soiling of carpet.
- B. Do not commence installation until painting and finishing work are complete, and ceiling and overhead work have been tested, approved and completed.
- C. Remove and replace existing carpet (renovations) in accordance with pre-approved architectural plan.

1.13 WARRANTY

- A. Warranty Performance Requirements
 - 1. Warranties must be for Lifetime on all items.
 - 2. Lifetime warranties must cover face components and backing components
 - 3. Warranties must be non-prorated.
 - 4. Carpet manufacturer must warrant both product and adhesive systems.
- B. Provide manufacturer's lifetime warranties as outlined below
 - 1. Wear
 - 2. Static
 - 3. Edge Ravel
 - 4. Zippering
 - 5. Dimensional Stability
 - 6. Impervious to Liquids
- C. Supplemental Fiber Warranty Items:
 - 1. Colorfastness to Light
 - 2. 10 Year Stain Warranty
 - 3. 10 Year - Colorfastness to Atmospheric contaminants.

1.14 EXTRA MATERIALS

- A. Provide 10 percent overage of calculated yardage for each type of carpet (include carpet needed for complete installation plus waste and usable scraps in calculated yardage) as specified by architect and/or end user. Recycle waste, unusable scrap

and any modular carpet damaged during installation through a qualified industry recycling or manufacturer environmental program.

- B. Deliver specified attic stock requirements to Owner's designated storage space, properly packaged and identified.

PART 2: PRODUCTS

2.1 MANUFACTURERS

- A. The Mohawk Group, 500 TownPark Lane, #400, Kennesaw, GA 30144. Telephone 800.554.6637. Web Site: www.themohawkgroup.com.
- B. Substitutions:
 - 1. Substitutions or variations in the backing system composites are not allowed.
 - 2. Substitutions or variations in any part of this specification either in product pattern, color, gauge or fiber are not allowed.
 - a. Must have choice of at least 10 running line products.

2.2 MODULAR CARPET TILE CONSTRUCTION

- A. All yarn and other carpet materials shall be manufacturer's first quality.
- B. Modular backing composite shall be constructed in the following manner:
- C. Backing Material/Composition
 - 1. Primary – Reinforced synthetic – non woven
 - 2. Bonding Agent – Premium vinyl composite polymer
 - 3. Secondary – Fiberglass reinforced vinyl composite polymer
 - 4. Total Backing Weight: Minimum of 110 ounces per square yard

D. DETAILED PRODUCT CONSTRUCTION SPECIFICATIONS

Collection	Organic Matrix BT235 BOTANICAL ORIGINS
Brand	Bigelow
Product Type	Tile
Minimum Sq. Yd.	DESIGN No minimum
Construction	Tufted
Surface Texture	Textured Multi Colored Loop
Gauge	1/12 (47.00 rows per 10 cm)
Density	6600
Weight Density	145,200
Stitches Per Inch	10.0 (39.37 per 10 cm)
Finished Pile	.120" (3.05 mm)
Thickness	
Dye Method	Solution Dyed
Backing Material	EcoFlex ICT
Alternate Backing	Upgrade to NXT Backing for Red List Free. Min req'd. Contact Rep for Details.
Fiber Type	Colorstrand® SD Nylon
Face Weight	22 oz. per sq. yd. (746.02 g/m2)
Pattern Repeat	Not Applicable
Size/Width	24" x 24" (.6096 m x .6096 m)
Soil Release	Sentry
Technology	
Installation Method	Monolithic, Quarter Turn
Indoor Air Quality	<u>Green Label Plus 1098</u>
Foot Traffic	Heavy
Recommendation	
TARR	
NSF 140	Gold
PERFORMANCE	
Static	AATCC-134 Under 3.5 KV
Flammability	ASTM E 648 Class 1 (Glue Down)
Smoke Density	ASTM E 662 Less than 450

E. All specifications are subject to normal manufacturing tolerances

2.3 ENVIRONMENTAL ATTRIBUTES AND CRITERIA

1. Environmental claims by manufacturer must comply with FTC guidelines.
2. Low Emitting Materials – Modular Carpet. Carpet must pass the Carpet and Rug Institute Green Label Plus Program for VOC emissions.
3. Low Emitting Materials: Modular Carpet and all installation components including adhesives, sealers, seam welds and seam sealers must meet the *Low Emitting*

Materials standards as outlined in U.S. Green Building Council LEED criteria. Adhesives must meet VOC emissions standards per South Coast Air Quality Management District Rule #1168.

4. Installation adhesives must pass the CRI Green Label plus equivalent protocol for VOC emissions.
5. End of Life Reclamation – Carpet manufacturers must have existing program in place to achieve landfill diversion. Refer to Section 3.7 of this section for specific requirements for reclamation of material. ReCover – Carpet recycling program, call toll free 877-373-2925.
6. Environmentally Preferred Product – Carpet must have third party certification (such as Scientific Certification Systems) in accordance with SNF-140 Sustainable Carpet Assessment standard as an Environmentally Preferred Product (EPP).
7. Carpet Face Yarn: In accordance with Executive Order 13101, carpet face yarn must contain minimum 25% pre-consumer Recycled content.
8. Manufacturer's recycled yarn content claim must be third party certified by Scientific Certification Systems or other third party auditing company.

2.4 ACCESSORIES

1. Leveling Compound: Latex type as recommended by carpet manufacturer; compatible with carpet adhesive and curling/sealing compound used on concrete.
2. Multipurpose Adhesive: Low VOC NuBroadlok™ modular adhesive or NuSprayLok™ adhesive, as recommended by carpet manufacturer for direct glue down of modular tiles; comply with CRI Green Label Certification Program.
3. Non-Metallic Carpet edge Guard: Extruded or molded heavy-duty vinyl or rubber carpet edge guard of size and profile indicated; minimum two (2) inch wide anchorage flange; colors selected by (Architect) (Designer) from manufacturer's standard range of colors.
4. Miscellaneous Materials: As recommended by manufacturer of carpet, cushion, and other carpet products; as required to complete installation.

PART 3 EXECUTION

3.1 EXAMINATION

1. Examine substrates for conditions under which modular carpet tiles are to be installed.
2. Verify that floor surfaces are smooth and flat within tolerances specified in Section 3.2 and are ready to receive work.

3.2 3. Beginning of installation means installer accepts existing substrate conditions.
PREPARATION

- A. Allow new concrete to cure for 90 days before carpet installation starts.
- B. Perform moisture content testing as required by manufacturer's instructions to ensure pH readings of no more than nine (9). Moisture transmission of 3.0-lbs/sq. ft per 24 hours is acceptable. If values exceed this level, follow manufacturer's recommendations for moisture transmission mitigation. Do not proceed until unsatisfactory conditions have been corrected.
- C. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes and other defects with sub-floor filler.
- D. Fill, level and make smooth cracks 1/16 inch or more, holes, unevenness, and roughness with compatible latex floor patching compounds. Feather floor filling or leveling compound a minimum of four (4) ft. Sweep floor of loose granular debris prior to filling. After filling, allow filler to dry. Damp mop floor with warm water and allow to dry. Vacuum after mopping to ensure that loose granular debris is removed and to provide a proper substrate to install modular carpet. Prohibit traffic until filler is cured.
- E. Vacuum floor again immediately before installation of carpeting.
- F. Confirm compatibility of NuBroadlok™ or NuSprayLok™ premium releasable carpet tile adhesive with curing compounds on concrete floors.
- G. Preheat areas to receive modular carpet to a minimum temperature of 68° F for 72 hours prior to installation, with a relative humidity of not more than 65 percent. Maintain minimum temperature of 50° F thereafter. Modular carpet and adhesive must be stored at a minimum temperature of 68° F, for 72 hours prior to installation.
- H. Store NuBroadlok™ or NuSprayLok™ premium releasable carpet tile adhesive and other liquid materials in same atmospheric conditions as carpet, 68° F for at least 72 hours.

3.3 INSTALLATION

- A. Install modular carpet in accordance with the Technical Bulletins provided by the manufacturer. These technical bulletins will offer the proper instructions to install modular carpet including: (1) conducting site testing and conditioning, (2) floor preparation, (3) installation of the modular carpet, including modular carpet layout (if more than one pattern or color) and approved adhesives, systems, etc. As a supplement, the CRI 104, section 8 will supply additional installation support guidance for your installation.
- B. Install modular carpet under open-bottom obstructions and under removable flanges and furnishings, and into alcoves and closets in each space.
- C. Conceal cut edges with protective edge guards or flanges.
- D. Install modular carpet under open-bottom items and cut tiles tight against walls, columns, and cabinets so that the entire floor area is covered with modular carpet. Cover over floor-type door closers.
- E. Install edging guards at openings and doors wherever modular carpet terminates, unless indicated otherwise.
- F. Perform cutting in accordance with manufacturer's recommendation using tools designed for modular carpet being installed. Verify modular carpet patterns and colors before cutting to insure minimal variation between dye lots.
- G. Install modular carpet according to manufacturer's instructions. Depending on the product specification, install either monolithically, quarter turned, Ashlar, or random. Installation requirements will be spelled out in the architectural drawings for the recommended method to be employed.
- H. Use leveling compound where necessary. Feather floor leveling compounds minimum of 4 ft.
- I. Trim modular carpet neatly at walls, and around interruptions
- J. Complete installation of edge strips, concealing exposed edges.
- K. Cut modular carpet at fixtures, architectural elements, and perimeters.
- L. Install carpet on stairs using acceptable permanent adhesive. Furnish and use compatible edge strip and nosing products as required.

3.4 FIELD QUALITY CONTROL

- A. Inspect completed modular carpet installation on each floor
- B. Verify that installation is complete; work is properly done and acceptable
- C. Remove and replace, at no additional cost to owner, any work found not to be acceptable.

3.5 CLEANING

- A. On completion of installation in each area, remove dirt and scraps from surface of finished modular carpet. Clean soiling, spots, or excess adhesive on carpet with cleaning materials recommended by carpet manufacturer
- B. Remove debris; sort pieces from carpet scraps
- C. At completion of work, vacuum carpet using commercial vacuuming equipment as recommended by manufacturer. Remove spots and replace modular carpet where spots cannot be removed. Remove rejected modular carpet pieces and replace with new modules. Remove any protruding yarns with shears or sharp scissors.

3.6 PROTECTION

- A. Do not permit traffic over unprotected carpet surface.
- B. Protect modular carpet against damage during construction. Cover with 6-mil thick polyethylene during construction period so that carpet will be without soiling, deterioration, wear, or damage at time of completion.
- C. Prior to furniture move in, heavy traffic areas will be protected with additional masonite sheets to protect the carpet from damage
- D. Damaged modular carpet will be rejected. As modular carpet is installed, remove trimmings, scraps of carpet and installation materials.
- E. Maintain protection of carpeting on each floor or area until work is accepted.

END OF SECTION 096813

NOT FOR BID

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Wood Trim, Panelling, Fascia's and soffits where not Pre-Finished..
 - 2. Steel
 - 3. Galvanized metal.
- B. Related Sections include the following:
 - 1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
 - 2. Division 06 Sections for shop priming carpentry with primers specified in this Section.
 - 3. Division 07 Sections for Pre-Finished Fiber Cement Siding.
 - 4. Division 09 painting Sections for special-use coatings.
 - 5. Division 09 Section "Interior Painting" for surface preparation and the application of paint systems on interior substrates.
 - 6. Division 09 Section "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on exterior wood Exposed Rafter Tails Wood Fascias and T & G Wood Soffits substrates.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each finish and for each color and texture required.
- C. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.3 QUALITY ASSURANCE

- A. MPI Standards:
 - 1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List." All painting work shall be in accordance with MPI Premium Grade Finish Requirements.

2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.
 - B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
 2. Final approval of color selections will be based on benchmark samples.
 - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.
- 1.4 EXTRA MATERIALS
- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
 1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

2.2 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Dunn-Edwards Corporation.
 - 2. Sherwin-Williams Company (The).
 - 3. Behr Paint
- C. Colors: As indicated in a color schedule.

2.3 BLOCK FILLERS

- A. Interior/Exterior Latex Block Filler: MPI #4.
 - 1. VOC Content: E Range of E2.

2.4 PRIMERS/SEALERS

- A. Alkali-Resistant Primer: MPI #3.
 - 1. VOC Content: E Range of E2.
- B. Bonding Primer (Water Based): MPI #17.
 - 1. VOC Content: E Range of E2.
- C. Bonding Primer (Solvent Based): MPI #69.
 - 1. VOC Content: E Range of E2.
- D. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint system indicated.

2.5 METAL PRIMERS

- A. Alkyd Anticorrosive Metal Primer: MPI #79.
 - 1. VOC Content: E Range of E2.
- B. Quick-Drying Alkyd Metal Primer: MPI #76.

1. VOC Content: E Range of E2.
- C. Cementitious Galvanized-Metal Primer: MPI #26.
 1. VOC Content: E Range of E1.
- D. Quick-Drying Primer for Aluminum: MPI #95.
 1. VOC Content: E Range of E2.

2.6 WOOD PRIMERS

- A. Exterior Latex Wood Primer: MPI #6.
 1. VOC Content: E Range of E2.
- B. Exterior Alkyd Wood Primer: MPI #5.
 1. VOC Content: E Range of E2.
- C. Exterior Oil Wood Primer: MPI #7.
 1. VOC Content: E Range of E2.

2.7 EXTERIOR LATEX PAINTS

- A. Exterior Latex (Flat): MPI #10 (Gloss Level 1).
 1. VOC Content: E Range of E2.
- B. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).
 1. VOC Content: E Range of E2.
- C. Exterior Latex (Gloss): MPI #119 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).
 1. VOC Content: E Range of E2.

2.8 EXTERIOR ALKYD PAINTS

- A. Exterior Alkyd Enamel (Flat): MPI #8 (Gloss Level 1).
 1. VOC Content: E Range of E1.

B. Exterior Alkyd Enamel (Semigloss): MPI #94 (Gloss Level 5).

1. VOC Content: E Range of E2.

C. Exterior Alkyd Enamel (Gloss): MPI #9 (Gloss Level 6).

1. VOC Content: E Range of E2.

2.9 QUICK-DRYING ENAMELS

A. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).

1. VOC Content: E Range of E2.

2.10 FLOOR COATINGS

A. Interior/Exterior Clear Concrete Floor Sealer (Water Based): MPI #99.

1. VOC Content: E Range of E2.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Plaster: 12 percent.
5. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION AND APPLICATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- D. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.3 EXTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 1. Elastomeric Wall Coating System: MPI EXT 3.1F.
 - a. Prime Coat: Exterior Epoxy Fortified acrylic primer/sealer.
 - b. Intermediate Coat: Exterior Acrylic Elastomeric wall Coating Topcoat.
 - c. Topcoat: Exterior Acrylic Elastomeric Topcoat (flat).
- B. Concrete Substrates, Traffic Surfaces:
 1. Latex Floor Paint System: MPI EXT 3.2A.
 - a. Prime Coat: Interior/exterior latex floor and porch paint (low gloss).
 - b. Intermediate Coat: Interior/exterior latex floor and porch paint (low gloss).
 - c. Topcoat: Interior/exterior latex floor and porch paint (low gloss).

2. Water-Based Clear Sealer System: MPI EXT 3.2H.

- a. Prime Coat: Interior/exterior clear concrete floor sealer (water based).
- b. Intermediate Coat: Interior/exterior clear concrete floor sealer (water based).
- c. Topcoat: Interior/exterior clear concrete floor sealer (water based).

C. Clay-Masonry Substrates:

1. Latex System: MPI EXT 4.1A.

- a. Prime Coat: Exterior latex matching topcoat.
- b. Intermediate Coat: Exterior latex matching topcoat.
- c. Topcoat: Exterior latex (flat).

2. High-Build Latex System: MPI EXT 4.1H, applied to form dry film thickness of not less than 10 mils.

- a. Prime Coat: As recommended in writing by topcoat manufacturer.
- b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
- c. Topcoat: High-build latex (exterior).

3. Latex Aggregate System: MPI EXT 4.1B.

- a. Prime Coat: As recommended in writing by topcoat manufacturer.
- b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
- c. Topcoat: Latex stucco and masonry textured coating.

D. CMU Substrates:

1. Latex System: MPI EXT 4.2A.

- a. Prime Coat: Interior/exterior latex block filler.
- b. Intermediate Coat: Exterior latex matching topcoat.
- c. Topcoat: Exterior latex (semigloss).

E. Steel Substrates:

1. Quick-Drying Enamel System: MPI EXT 5.1A.

- a. Prime Coat: Quick-drying alkyd metal primer.
- b. Intermediate Coat: Quick-drying enamel matching topcoat.
- c. Topcoat: Quick-drying enamel (semigloss).

F. Galvanized-Metal Substrates:

1. Latex Over Water-Based Primer System: MPI EXT 5.3H.
 - a. Prime Coat: Waterborne galvanized-metal primer.
 - b. Intermediate Coat: Exterior latex matching topcoat.
 - c. Topcoat: Exterior latex (semigloss).
2. Alkyd System: MPI EXT 5.3B.
 - a. Prime Coat: Cementitious galvanized-metal primer.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel (semigloss).

G. Aluminum Substrates:

1. Latex System: MPI EXT 5.4H.
 - a. Prime Coat: Quick-drying primer for aluminum.
 - b. Intermediate Coat: Exterior latex matching topcoat.
 - c. Topcoat: Exterior latex (semigloss).

H. Plastic Trim Fabrication Substrates:

1. Latex System: MPI EXT 6.8A.
 - a. Prime Coat: Bonding primer (water based).
 - b. Intermediate Coat: Exterior latex matching topcoat.
 - c. Topcoat: Exterior latex (semigloss).

I. Stucco Substrates:

1. Latex System: MPI EXT 9.1A.
 - a. Prime Coat: Exterior latex matching topcoat.
 - b. Intermediate Coat: Exterior latex matching topcoat.
 - c. Topcoat: Exterior latex (flat).

J. Exterior Gypsum Board Substrates:

1. Latex System: MPI EXT 9.2A.
 - a. Prime Coat: Exterior latex matching topcoat.
 - b. Intermediate Coat: Exterior latex matching topcoat.
 - c. Topcoat: Exterior latex (flat).

K. Dressed Lumber Substrates: Including architectural woodwork Trim and Doors.

1. Latex System: MPI EXT 6.3L.

- a. Prime Coat: Exterior latex wood primer.
- b. Intermediate Coat: Exterior latex matching topcoat.
- c. Topcoat: Exterior latex semigloss.

L. Wood Panel Substrates: Including plywood siding, fascia's and soffits.

1. Latex System: MPI EXT 6.4K.

- a. Prime Coat: Exterior latex wood primer.
- b. Intermediate Coat: Exterior latex matching topcoat.
- c. Topcoat: Exterior latex semigloss.

END OF SECTION 099113

NOT FOR BID

SECTION 099123 - INTERIOR PAINTING

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 this Section.

1.2 SUMMARY

- A. This Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Steel.
 - 2. Aluminum (not anodized or otherwise coated).
 - 3. Wood.
 - 4. Gypsum board.
- B. Related Sections include the following:
 - 1. Division 05 Sections for shop priming of metal substrates with primers specified in this Section.
 - 2. Division 06 Sections for shop priming carpentry with primers specified in this Section.
 - 3. Division 09 Section "Exterior Painting" and "Staining & Transparent Finishing for surface preparation and the application of paint systems on exterior substrates.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.

- D. Product List: For each product indicated, include the following:
1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 QUALITY ASSURANCE

- A. MPI Standards:
1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
 2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.
- B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
 3. Final approval of color selections will be based on benchmark samples.
 - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
 - 1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

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. Dunn-Edwards Corporation.
 - 2. Sherwin-Williams Company (The).
 - 3. Behr Paint

2.2 PAINT, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

- B. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
1. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
 3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 4. Floor Coatings: VOC not more than 100 g/L.
 5. Shellacs, Clear: VOC not more than 730 g/L.
 6. Shellacs, Pigmented: VOC not more than 550 g/L.
 7. Flat Topcoat Paints: VOC content of not more than 50 g/L.
 8. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
 9. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
 10. Floor Coatings: VOC not more than 100 g/L.
 11. Shellacs, Clear: VOC not more than 730 g/L.
 12. Shellacs, Pigmented: VOC not more than 550 g/L.
 13. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
 14. Dry-Fog Coatings: VOC content of not more than 400 g/L.
 15. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
 16. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.
- C. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 2. Restricted Components: Paints and coatings shall not contain any of the following:
 - a. Acrolein.
 - b. Acrylonitrile.
 - c. Antimony.
 - d. Benzene.
 - e. Butyl benzyl phthalate.
 - f. Cadmium.
 - g. Di (2-ethylhexyl) phthalate.
 - h. Di-n-butyl phthalate.
 - i. Di-n-octyl phthalate.

- j. 1,2-dichlorobenzene.
- k. Diethyl phthalate.
- l. Dimethyl phthalate.
- m. Ethylbenzene.
- n. Formaldehyde.
- o. Hexavalent chromium.
- p. Isophorone.
- q. Lead.
- r. Mercury.
- s. Methyl ethyl ketone.
- t. Methyl isobutyl ketone.
- u. Methylene chloride.
- v. Naphthalene.
- w. Toluene (methylbenzene).
- x. 1,1,1-trichloroethane.
- y. Vinyl chloride.

- D. Colors: As selected by Architect from manufacturer's full range and as indicated in a color schedule.

2.3 BLOCK FILLERS

- A. Interior/Exterior Latex Block Filler: MPI #4.

- 1. VOC Content: E Range of E2.

2.4 PRIMERS/SEALERS

- A. Interior Latex Primer/Sealer: MPI #50.

- 1. VOC Content: E Range of E2.
- 2. Environmental Performance Rating: EPR 2.

- B. Interior Alkyd Primer/Sealer: MPI #45.

- 1. VOC Content: E Range of E2.

- C. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.5 METAL PRIMERS

- A. Alkyd Anticorrosive Metal Primer: MPI #79.

1. VOC Content: E Range of E2.
- B. Quick-Drying Alkyd Metal Primer: MPI #76.
 1. VOC Content: E Range of E2.
- C. Rust-Inhibitive Primer (Water Based): MPI #107.
 1. VOC Content: E Range of E2.
 2. Environmental Performance Rating: EPR 2.
- D. Waterborne Galvanized-Metal Primer: MPI #134.
 1. VOC Content: E Range of E2.
 2. Environmental Performance Rating: EPR 2.
- E. Vinyl Wash Primer: MPI #80.
 1. VOC Content: E Range of E2.
- F. Quick-Drying Primer for Aluminum: MPI #95.
 1. VOC Content: E Range of E2.

2.6 WOOD PRIMERS

- A. Interior Latex-Based Wood Primer: MPI #39.
 1. VOC Content: E Range of E2.
 2. Environmental Performance Rating: EPR 2.

2.7 LATEX PAINTS

- A. Interior Latex (Flat): MPI #53 (Gloss Level 1).
 1. VOC Content: E Range of E2.
 2. Environmental Performance Rating: EPR 0.5.
- B. Interior Latex (Low Sheen): MPI #44 (Gloss Level 2).
 1. VOC Content: E Range of E2.
 2. Environmental Performance Rating: EPR 2.
- C. Interior Latex (Eggshell): MPI #52 (Gloss Level 3).

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 2.

D. Interior Latex (Satin): MPI #43 (Gloss Level 4).

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 1.5.

E. Interior Latex (Semigloss): MPI #54 (Gloss Level 5).

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 2.

F. Interior Latex (Gloss): MPI #114 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 2.

2.8 ALKYD PAINTS

A. Interior Alkyd (Flat): MPI #49 (Gloss Level 1).

1. VOC Content: E Range of E2.

B. Interior Alkyd (Eggshell): MPI #51 (Gloss Level 3).

1. VOC Content: E Range of E2.

C. Interior Alkyd (Semigloss): MPI #47 (Gloss Level 5).

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 2.

D. Interior Alkyd (Gloss): MPI #48 (Gloss Level 6).

1. VOC Content: E Range of E2.

2.9 QUICK-DRYING ENAMELS

A. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).

1. VOC Content: E Range of E2.

- B. Quick-Drying Enamel (High Gloss): MPI #96 (Gloss Level 7).

1. VOC Content: E Range of E2.

2.10 DRY FOG/FALL COATINGS

- A. Latex Dry Fog/Fall: MPI #118.

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 2.

- B. Waterborne Dry Fall: MPI #133.

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 2.

- C. Interior Alkyd Dry Fog/Fall: MPI #55.

1. VOC Content: E Range of E2.

2.11 FLOOR COATINGS

- A. Interior/Exterior Clear Concrete Floor Sealer (Water Based): MPI #99.

1. VOC Content: E Range of E2.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.

5. Plaster: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
 2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- C. Clean substrate of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Clay Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content of surfaces or alkalinity of mortar joints to be painted exceed that permitted in manufacturer's written instructions.
- F. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- G. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove surface oxidation.
- J. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- K. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.
- L. Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.
- M. Spray-Textured Ceiling Substrates: Do not begin paint application until surfaces are dry.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions.
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

- E. Painting Mechanical and Electrical Work: Paint all items exposed in equipment rooms and occupied spaces including, but not limited to, the following:

1. Mechanical Work:

- a. Uninsulated metal piping.
- b. Uninsulated plastic piping.
- c. Pipe hangers and supports.
- d. Tanks that do not have factory-applied final finishes.
- e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
- f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
- g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

2. Electrical Work:

- a. Switchgear.
- b. Panelboards.
- c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

3.4 FIELD QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:

- 1. Quick-Drying Enamel System: MPI INT 5.1A.
 - a. Prime Coat: Quick-drying alkyd metal primer.
 - b. Intermediate Coat: Quick-drying enamel matching topcoat.
 - c. Topcoat: Quick-drying enamel (semigloss).

B. Galvanized-Metal Substrates:

- 1. Alkyd System: MPI INT 5.3C.
 - a. Prime Coat: galvanized-metal primer.
 - b. Intermediate Coat: Interior alkyd matching topcoat.
 - c. Topcoat: Interior alkyd (semigloss).

C. Exposed Wood Beams Substrates:

- 1. See Division 09 for Semi-Transparent Finishing.

D. Dimension Lumber Substrates, Nontraffic Surfaces: Including exposed joists exposed beams except as noted to be semi-transparent finish..

- 1. Latex System: MPI INT 6.2D.
 - a. Prime Coat: Interior latex-based wood primer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex (eggshell).

E. Gypsum Board Substrates:

- 1. Latex System: MPI INT 9.2A.

- a. Prime Coat: Interior latex primer/sealer matching topcoat.
- b. Intermediate Coat: Interior latex matching topcoat.
- c. Topcoat: Interior latex (Eggshell Walls & Flat Ceilings).

END OF SECTION 099123

NOT FOR BID

SECTION 099300 - STAINING AND TRANSPARENT FINISHING

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 this Section.

1.2 SUMMARY

- A. This Section includes surface preparation and the application of wood finishes on the following substrates:
 - 1. Exterior Substrates:
 - a. Exposed wood beams and columns.
 - b. Exposed dimension lumber (rough carpentry).
 - c. Dressed lumber (finish carpentry).
 - d. Exposed wood rafter tails.
 - 2. Interior Substrates:
 - a. Exposed wood beams.
 - b. Exposed dimension lumber (rough carpentry).
 - c. Dressed lumber (finish carpentry).
 - d. Exposed wood panel products.
- B. Related Sections include the following:
 - 1. Division 09 Section "Exterior Painting" for surface preparation and application of standard paint systems on exterior substrates.
 - 2. Division 09 Section "Interior Painting" for surface preparation and application of standard paint systems on interior substrates.
 - 3. Division 09 painting Sections for special-use coatings.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of product indicated.

- C. Samples for Verification: For each type of finish system and in each color and gloss of finish indicated.
 - 1. Submit Samples on representative samples of actual wood substrates, 8 inches square.
 - 2. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
 - 1. Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules.
 - 2. Printout of MPI's current "MPI Approved Products List" for each product category specified in Part 2, with the product proposed for use highlighted.

1.4 QUALITY ASSURANCE

- A. MPI Standards:
 - 1. Products: Complying with MPI standards indicated and listed in its "MPI Approved Products List."
 - 2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and finish systems indicated.
- B. Mockups: Apply benchmark samples of each finish system indicated and each color selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of stain color selections will be based on benchmark samples.
 - a. If preliminary stain color selections are not approved, apply additional benchmark samples of additional stain colors selected by Architect at no added cost to Owner.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

- A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply exterior finishes in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.
 1. Quantity: Furnish an additional 5 percent, but not less than 5 gal. of each material and color applied.

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. Dunn-Edwards Corporation.
 2. Behr Paint
 3. Sherwin-Williams Company (The)

2.2 MATERIALS, GENERAL

- A. Material Compatibility:

1. Provide materials for use within each finish system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a finish system, provide products recommended in writing by manufacturers of topcoat for use in finish system and on substrate indicated.
- B. VOC Content of Field-Applied Interior Primers, Stains, and Transparent Finishes: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to primers, stains, and transparent finishes that are applied in a fabrication or finishing shop:
1. Flat Primers: VOC content of not more than 50 g/L.
 2. Nonflat Primers: VOC content of not more than 150 g/L.
 3. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
 4. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 5. Clear Wood Finishes, Lacquers: VOC not more than 550 g/L.
 6. Floor Coatings: VOC not more than 100 g/L.
 7. Shellacs, Clear: VOC not more than 730 g/L.
 8. Stains: VOC not more than 250 g/L.
- C. Stain Colors: As indicated in a color schedule.
- 2.3 WOOD FILLERS
- A. Wood Filler Paste: MPI #91.
1. VOC Content: E Range of E2.
- 2.4 PRIMERS AND SEALERS
- A. Exterior Alkyd Wood Primer: MPI #5.
1. VOC Content: E Range of E2.
- B. Exterior Latex Wood Primer: MPI #6.
1. VOC Content: E Range of E2.
- C. Exterior Oil Wood Primer: MPI #7.
1. VOC Content: E Range of E2.
- D. Wood Preservative: MPI #37.

1. VOC Content: E Range of E3.
- E. Alkyd Sanding Sealer: MPI #102.
 1. VOC Content: E Range of E2.
- F. Lacquer Sanding Sealer: MPI #84.
 1. VOC Content: E Range of E2.
- G. Shellac: MPI #88.
 1. VOC Content: E Range of E2.

2.5 STAINS

- A. Exterior Semitransparent Stain (Solvent Based): MPI #13.
 1. VOC Content: E Range of E2.
- B. Exterior Solid-Color Stain (Solvent Based): MPI #14.
 1. VOC Content: E Range of E2.
- C. Exterior, Solid-Color Latex Stain: MPI #16.
 1. VOC Content: E Range of E2.
- D. Stain for Wood Decks: MPI #33.
 1. VOC Content: E Range of E3.
- E. Interior Wood Stain (Semitransparent): MPI #90.
 1. VOC Content: E Range of E2.

2.6 VARNISHES

- A. Exterior Marine Spar Varnish (Gloss): MPI #28, Gloss Level 7.
 1. VOC Content: E Range of E2.
- B. Exterior Varnish (Gloss): MPI #29, Gloss Level 6.
 1. VOC Content: E Range of E1.
- C. Exterior Varnish (Semigloss): MPI #30, Gloss Level 5.

1. VOC Content: E Range of E1.
- D. Interior Varnish (Flat): MPI #73, Gloss Level 1, alkyd type.
 1. VOC Content: E Range of E2.
- E. Interior Varnish (Semigloss): MPI #74, Gloss Level 5, alkyd type.
 1. VOC Content: E Range of E2.
- F. Interior Varnish (Gloss): MPI #75, Gloss Level 6, alkyd type.
 1. VOC Content: E Range of E2.

2.7 POLYURETHANE FINISHES

- A. Two-Component Aliphatic Polyurethane (Clear): MPI #78.
 1. VOC Content: E Range of E2.
- B. Interior, Oil-Modified, Clear Urethane (Satin): MPI #57, Gloss Level 4.
 1. VOC Content: E Range of E2.
- C. Interior, Oil-Modified, Clear Urethane (Gloss): MPI #56, Gloss Level 6.
 1. VOC Content: E Range of E2.
- D. Moisture-Cured Clear Polyurethane (Flat): MPI #71, Gloss Level 1.
 1. VOC Content: E Range of E2.
- E. Moisture-Cured Clear Polyurethane (Gloss): MPI #31.
 1. VOC Content: E Range of E2.

2.8 WATERBORNE ACRYLIC FINISHES

- A. Waterborne Clear Acrylic (Satin): MPI #128, Gloss Level 4.
 1. VOC Content: E Range of E2.
 2. Environmental Performance Rating: EPR 2.
- B. Waterborne Clear Acrylic (Semigloss): MPI #129, Gloss Level 5.

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 2.

C. Waterborne Clear Acrylic (Gloss): MPI #130, Gloss Level 6.

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 2.

2.9 LACQUERS

A. Lacquer (Clear Flat): MPI #87, Gloss Level 1.

1. VOC Content: E Range of E2.

B. Lacquer (Clear Satin): MPI #85, Gloss Level 4.

1. VOC Content: E Range of E2.

C. Lacquer (Clear Gloss): MPI #86, Gloss Level 6.

1. VOC Content: E Range of E2.

2.10 OIL FINISH

A. Danish Oil: MPI #92.

1. VOC Content: E Range of E3.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
1. Maximum Moisture Content of Wood Substrates: 15 percent when measured with an electronic moisture meter.
 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes.
 3. Begin finish application only after unsatisfactory conditions have been corrected and surfaces are dry.

4. Beginning application of finish system constitutes Contractor's acceptance of substrate and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be finished. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
 1. After completing finishing operations, reinstall items that were removed; use workers skilled in the trades involved. Remove surface-applied protection if any.
- C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.
 1. Remove surface dirt, oil, or grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
 2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.
 3. Countersink steel nails, if used, and fill with putty tinted to final color to eliminate rust leach stains.
- D. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.

3.3 APPLICATION

- A. Apply finishes according to manufacturer's written instructions.
 1. Use applicators and techniques suited for finish and substrate indicated.
 2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
- B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 FIELD QUALITY CONTROL

- A. Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when finishes are being applied:

1. Owner will engage the services of a qualified testing agency to sample finish materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces if, on refinishing with complying materials, the two finishes are incompatible.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

3.6 EXTERIOR WOOD-FINISH-SYSTEM SCHEDULE

- A. Exposed Glue-Laminated Beam and Column Substrates:
 1. Varnish Over Semitransparent Stain System: MPI EXT 6.1D.
 - a. Stain Coat: Exterior semitransparent stain (solvent based).
 - b. Two Finish Coats: Exterior varnish (semigloss).
- B. Exposed Rough Carpentry Substrates:
 1. Varnish Over Semitransparent Stain System: MPI EXT 6.2E.
 - a. Stain Coat: Exterior semitransparent stain (solvent based).
 - b. Two Finish Coats: Exterior varnish (semigloss).
- C. Finish Carpentry Substrates:

1. Varnish Over Semitransparent Stain System: MPI EXT 6.3E.
 - a. Stain Coat: Exterior semitransparent stain (solvent based).
 - b. Two Finish Coats: Exterior varnish (semigloss).

3.7 INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

A. Exposed Beams and Column Substrates:

1. Alkyd Varnish Over Stain System: MPI INT 6.1K.
 - a. Stain Coat: Interior wood stain (semitransparent).
 - b. Two Finish Coats: Interior varnish (semigloss).

B. Exposed Rough Carpentry Substrates:

1. Alkyd Varnish Over Stain and Sealer System: MPI INT 6.2K.
 - a. Stain Coat: Interior wood stain (semitransparent).
 - b. Seal Coat: Alkyd sanding sealer.
 - c. One Finish Coat: Interior varnish (semigloss).

C. Finish Carpentry Substrates:

1. Alkyd Varnish Over Stain and Sealer System: MPI INT 6.3D.
 - a. Stain Coat: Interior wood stain (semitransparent).
 - b. Seal Coat: Alkyd sanding sealer.
 - c. Two Finish Coats: Interior varnish (semigloss).

END OF SECTION 099300

SECTION 101400 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Standard Specifications: The provisions of the Standard Specifications shall apply except as modified herein.
- B. Reference Standards: The following standards also apply to the Work of this section:
CalTrans Traffic Manual, latest edition;
CalTrans Maintenance Manual, latest edition; and,
CalTrans Standard Plans and Specifications, latest edition.

1.2 SCOPE: The Work of this Section shall consist of furnishing all labor, materials, equipment, appliances and services necessary for the execution and completion of all Signage Work as shown on the Plans and as described in the Specifications including, but not necessarily limited to, the following:

- A. Building Signage, both interior and exterior including, but not necessarily limited to the following:
 - 1. Address Numerals;
 - 2. Occupancy Sign;
 - 3. Restroom Signs;
- B. Construction Signs (Temporary);
 - 1. Construction Worksite Access; and,
Project Signs;
- C. Site Signs, including but not necessarily limited to the following:
 - 1. Fire Hydrant Marker, blue pavement mounted reflector type;
 - 2. Handicapped Parking Stall Signs;
 - 3. "Symbol", sign #R99; and,
 - 4. "Special Placard or License Plate Required", sign #R100;
 - 5. Parking Lot Accessibility Signs;
 - 6. Parking Lot Identification Signs;
 - 7. Roadway signs per CalTrans standards, to include:
 - 8. "Stop Sign", #R1 (24" in size); and,
- D. Coordination with Related Work of other Sections;
- E. Testing;
- F. Clean-up; and,
- G. Replacements, Repairs, Guarantees and Warranty Work.

1.3 RELATED WORK:

1. Submittals: Section 013300
2. Exterior Painting: Section 099113

1.4 GUARANTEE:

- A. All signage shall be guaranteed for a minimum period of one (1) year against all peeling, fading, chipping and deterioration of any kind.

1.5 SUBMITTALS:

- A. Shall be prepared and submitted in accordance with Technical Specifications Section 01300 Submittals, and shall consist of the following:
- B. Materials Lists/Manufacturer's Product Information: Contractor shall submit a complete list of materials along with the manufacturer's catalog cuts for all materials proposed for use in the Work at the preconstruction conference. Contractor shall also provide the Manufacturer's complete installation drawings including specifications and a replacement parts lists for all equipment proposed for the Project. Submit all Manufacturer's product information for each item specified for use in the Work.
- C. Proposed Substitutions: Submittals for Proposed Substitutions shall conform to Special Provisions Section 4-1.6.1 Proposed Substitutions. Products proposed for substitution as "equals" to the products specified are subject to the approval of the Architect and the Owner. If at the time proposed equals are delivered to the site and/or incorporated into the Work it is determined by the Architect that the substitute products are not equal to the products specified, the unacceptable substitute products shall be removed and products as specified shall be provided and installed by Contractor at no additional cost to County.
- D. Shop Drawings: Contractor shall prepare and submit Shop Drawings for all signage of this section which show complete details for all signs being fabricated. Shop Drawings shall show all methods of attachment, materials, letter styles, and height, finishes, colors, dimensions and locations for signs, and shall be prepared in accordance with Standard Specifications Section 2-5.3 Shop Drawings.
- E. Turn Over Items: The following "spare" signs and mounting materials shall be turned over to the State Parks Department Representative at the Final Acceptance Inspection: 3 ea., spare 4 x 4 redwood posts, ea. 10 foot in length; 3 sets spare mounting hardware; 1 ea. spare Roadway Sign of each type installed (No Parking, Stop & Speed Limit).

1.6 DELIVERY, STORAGE AND HANDLING:

- A. Contractor shall assume all responsibility for storage of all signage materials for the Project. City assumes no liability for losses or damages from any cause as a result of Contractor's storage of materials on site.

PART 2 - MATERIALS

2.1 GENERAL:

- A. Products used in the Work of this Section shall be produced by manufacturers regularly engaged in the manufacture of similar items with a history of successful production acceptable to the Park and Recreation Department.

2.2 BUILDING SIGNAGE:

- A. Address Numerals: Shall be metal numerals. Numerals shall be a minimum of eight inches in height.
- B. Occupancy Sign: Shall be 9" square, fabricated of metal with contrasting background and 1" high upper case letters in Helvetica Medium font. Sign text shall read: "MAXIMUM OCCUPANCY 225".
- C. Restroom Signs:
 - 1. Door Mounted Signs: For the Men's and Women's Restroom Doors shall be as shown on the Plans, fabricated of metal per Technical Specifications Section 05500 Metal Fabrication and painted in contrasting colors as directed by the Parks Department Representative and the Architect.
 - 2. Wall Mounted Signs: Shall be six inch square, fabricated of metal per Technical Specifications Section 05500 Metal Fabrication, with raised international symbol of accessibility and letters identifying the room name (Men's or Women's) and Grade 2 Braille; signs shall be painted same color as the door mounted signs.
- D. Storefront Signs: Shall be fabricated and painted as shown and detailed on the Architectural Plans.

2.3 CONSTRUCTION SIGNS (TEMPORARY):

- A. Construction Worksite Access: Contractor shall provide signage indicating "Construction Area - No Unauthorized Entry" and "No Trespassing" for mounting on the construction fence gate and fence lines respectively.
- B. Project Sign: Shall be provided to identify the project, and shall be constructed as detailed on the Architectural Plans. Portions of this temporary sign are to be incorporated into the permanent Visitor Center Storefront sign upon completion of the project.

2.4 SITE SIGNAGE:

- A. All site signage to be post mounted shall be furnished with metal sign posts of lengths as indicated and detailed on the drawings.
- B. Fire Hydrant Marker: Shall be blue pavement mounted reflector type, one per hydrant installed.

- C. Parking Lot Signs: Shall be fabricated from anodized aluminum blanks, minimum 0.063 inch thick, covered with engineer grade 3-M scotch-lite face, with contrasting color letters and/or

graphics.

1. Accessibility Signs: Shall be 17 inches x 22 inches in size with lettering not less than 1 inch in height, and shall read: "Unauthorized vehicles parked in designated accessible spaces not displaying distinguishing placards or license plates issued for persons with disabilities may be towed away at owner's expense. Towed vehicles may be claimed at _____ or by telephoning _____." Contractor shall coordinate with Owner's Representative and County to determine appropriate information to fill-in the two blanks in the preceding statement, prior to fabrication of the signs.
 2. Handicapped Parking Stall Signs:
 - a) "Symbol", sign #R99; shall consist of the white international symbol of accessibility on a blue background, The blue shall be Color No. 15090 in Federal Standard 595B. The "van accessible" parking space shall have an additional sign stating "Van-Accessible" mounted below the symbol of accessibility.
 - b) "Special Placard or License Plate Required", sign #R100; shall be fabricated with a white background and black text.
- D. Roadway Signs: Shall be fabricated from anodized aluminum blanks, minimum 0.063 inch thick, covered with engineer grade 3-M scotch-lite face, with contrasting color letters and/or graphics. Text, graphics and colors shall be per CalTrans standards as selected by the City, submit samples. Sign blanks are to be of the sizes noted with minimum 1/2 inch radius corners.

PART 3 - EXECUTION

3.1 GENERAL:

- A. Qualifications of Installers: Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.
- B. Coordination: Signs to be installed shall be coordinated with the various bid schedules awarded. All dimensions and conditions shall be field verified prior to any signs being fabricated. Contractor shall size foundations for sign posts per CalTrans standards.

3.2 BUILDING SIGNS:

- A. Address Numerals: Shall be mounted to the building as shown on the Plans.
- B. Occupancy Sign: Shall be wall mounted as shown on the Plans.
- C. Restroom Signs: Shall be mechanically fastened to their respective mounting surface. Mounting height shall be 60 inches above the finish floor to the centerline of the sign. Wall mounted signs shall be installed on the latch side of the restroom doorway; provide wood shim as required.
- D. Storefront Signs: Shall be mounted to the building false front as detailed on the Plans.

3.3 CONSTRUCTION SIGNS (TEMPORARY):

- A. Construction Worksite Access:
 - 1. Construction Area - No Unauthorized Entry: Signs shall be affixed to the construction fence at all entry gates into the construction work area.
 - 2. No Trespassing: Signs shall be affixed to the construction fence as specified in Special Provision Section 7-10.1.1 Construction Fence.
- B. Project Identification Sign: Shall be installed as detailed on the Architectural Plans.

3.4 SITE SIGNAGE: All site signage to be posted mounted shall be installed on 4 x 4 redwood posts with concrete foundations as indicated.

- A. Fire Hydrant Marker: Marker shall be provided for each fire hydrant installed in this Phase of the Project, and shall be installed affixed to the roadway asphalt pavement in accordance with the manufacturer's written instructions. Contractor shall furnish a minimum of three additional makers for turn-over to the County of San Bernardino Representative at the completion of the project.
- B. Parking Lot Signs:
 - 1. Accessibility Signs: Shall be mechanically fastened to metal sign post. Provide one sign at each entry to each parking lot (Lots 'E' and 'F' only).
 - 2. Handicap Parking Stall Signs: Shall be mechanically fastened to metal sign post. Provide one sign at each handicapped parking stall within lots 'E' and 'F' only.
 - 3. Lot Designation Signs: Shall be mechanically fastened to metal sign post with a mounting height of 18 inches clear between finish grade and the bottom of the sign. Provide one sign at each entry to each parking lot (includes existing lots 'A' thru 'D' and new lots 'E' and 'F').
- C. Plaque: Shall be installed with concealed mounting bolts into the concrete surface at the focal garden; face of plaque to be flush with the finish surface of the sidewalk. Location of plaque shall be as approved in the field by the County of San Bernardino Representative.
- D. Roadway Signs: Shall be mechanically fastened to metal sign posts. Provide one post per sign.

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- 3.8 COMPLETION CLEANING: Upon completion of the Work of this Section, Contractor shall clean all Signs installed removing all soil, concrete latence, stains, grease, dirt, etc., and shall polish all signs faces and other such surfaces that require such maintenance. Contractor shall remove all excess materials, rubbish, debris, etc., and remove construction equipment from the premises.
- 3.9 CLEAN-UP: Throughout the duration of the Project, Contractor shall provide trash receptacles for collecting debris, shall remove debris, trash and unused materials, and excess soil from the job site at regular intervals of not less than weekly and shall dispose of same off site in a legal manner.

END OF SECTION 101400

SECTION 102800 - TOILET & BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. The Work of this Section shall consist of furnishing all labor, materials, equipment, appliances and services necessary for the execution and completion of all Toilet Accessories Work as shown on the Plans and as described in the Specifications including, but not necessarily limited to, the following:

1. Mirrors;
2. Soap Dispensers;
3. Waste Receptacle;
4. Toilet Seat Cover Dispenser;
5. Toilet Paper Dispenser;
6. Handicap Grab Bars;
7. Folding Shower Seat
8. Coat Hanger
10. Shower Curtain
11. All other miscellaneous accessories as shown on the Plans;
12. Coordination with Work of other Sections;
13. Clean-up; and,
14. Replacements, Repairs, Guarantees and Warranty Work.

1.2 RELATED DOCUMENTS

- A. The provisions of the Standard Specifications shall apply except as modified herein.

1.3 RELATED WORK:

- A. Rough Carpentry (for backing) Section 061000

1.4 SUBMITTALS:

- A. Submit copies of each of the following per Special Provisions Section Shop Drawings and Submittals and Technical Specifications Section 013000 Submittals at the pre-construction conference for the review and approval of the City prior to commencement of any Work:

- B. Materials List/Catalog Cuts/Shop Drawings: Contractor shall submit a complete list of materials together with catalog cuts for each item proposed for incorporation into the Work. Contractor shall obtain the review and approval of the materials list by the Architect and County of San Bernardino Representative prior to ordering materials.
- C.. Turn Over Items: For Owner's permanent records, provide two sets of the following items:
 - 1. Technical Data Sheets for each item installed in the project;
 - 2. Keys and Service/Parts Manuals; and,
 - 3. Name of local representative to be contacted in the event of need of field service or consultation.

PART 2 - MATERIALS

2.1 GENERAL:

- A. Quality Assurance: Products used in the Work of this Section shall be produced by manufacturers regularly engaged in the manufacture of similar items with a history of successful production acceptable to the Parks Department Representative.
- B. Single Source Manufacturer: All equipment shall be supplied by a single source manufacturer, Bobrick Washroom Equipment, Inc.
- C. Mirrors:
 - 1. Whitehall Manufacturing Ligature Resistant Mirror: Handicap, Front Mount Model No. WH1813-SLPT.
- D. Shower head:
 - 1. Whitehall Ligature Resistant Wall Shower Head Model WH1741-CSH in White finish over stainless steel.
- E. ADA Shower Seat:
 - 1. Bobrick Solid Phenolic Folding Shower/Dressing Area Seat No. B-5191
- F. Toilet Tissue Dispenser:
 - 1. Bobrick B-3888 "ClassicSeries" Recessed-Mounted Multi-Roll Toilet Tissue Dispenser, satin stainless steel.
- G. Toilet-Seat Cover Dispenser:
 - 1. Bobrick B-301 "ClassicSeries" Recessed Seat-Cover Dispenser.

H. ADA Toilet Grab Bars:

1. Bobrick 1 ½" Dia. Straight/ Satin No. B-6806 x 42" Long Stainless Steel Grab Bar.
2. Bobrick 1 ½" Dia. Straight/ Satin No. B-6806 x 36" Long Stainless Steel Grab Bar.

I. ADA Shower Grab Bars:

1. Bobrick 1 ½" Dia. Straight Satin No. B-6806.99 x 48" Long Stainless Steel Grab Bar.

J. Robe/ Towel Hook:

1. Bobrick B-7671 "ClassicSeries" Single Robe Hook.

K. Soap Dispenser:

1. Bobrick B-822 Series Liquid Soap Dispenser with 6 inch long spout (34 Fl. Oz.)

PART 3 – EXECUTION

3.1 GENERAL

- A. All toilet accessories and fixtures are to be installed per the manufacturer's directions. Screws for installing the accessories shall be of adequate length to penetrate the wood blocking provided, to a minimum depth of ¾" of penetration. If the screws provided with the products are not of adequate length, Contractor shall provide replacement screws, of the same head types and finishes as the screws provided by the manufacturer, but of sufficient length to achieve the depth of penetration specified.

3.2 COORDINATE FOR BACKING

- A. Contractor shall coordinate with the Work of Section 061000 Rough Framing to ensure solid backing and adequate anchorage is provided. Backing shall be either 2" of wood framing, 1" of plywood, or a 14 gauge steel plate. The backing material shall be securely attached between the studs at the locations where the accessories are to be mounted. Toggle bolts or molly bolts through drywall are not considered sufficiently secure anchorage. Lead shields in Tile Work are not considered sufficiently secure anchorage.

3.3 CLEAN-UP

- A. All toilet accessories provided under this Section are to be cleaned and polished, free
B.

from scratches, dents, or blemishes of any kind, in like-new condition at the time of Final Acceptance of the Work. Upon completion of the Work of this Section, clean-up the work site, removing all trash, debris, and excess materials. Dispose of all trash and debris off site in a legal manner.

END OF SECTION 102800

SECTION 104413: FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1: GENERAL

1.1 WORK INCLUDED

- A. Fire Extinguishers
- B. Cabinets
- C. Accessories

1.2 RELATED WORK

- A. Section 099123 - Painting
- B. Section 210500 – Common Work Results For Fire Suppression

1.3 REFERENCES

- A. NFPA 10 - Portable Fire Extinguishers
- B. ADA Accessibility Guidelines

1.4 QUALITY ASSURANCE

- A. Conform to NFPA 10 requirements for portable fire extinguishers.
- B. Provide fire extinguishers, cabinets, and accessories by single manufacturer.

1.5 SUBMITTALS

- A. Submit product data in compliance with Section 013300.

PART 2: PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Where shown on the drawings, provide fire extinguishers. Cabinets and accessories manufactured by Larsen's Manufacturing Co., 7421 Commerce Lane N.E., Minneapolis, MN 55432 (763) 571-1181 or (800)527-7367.

2.2 FIRE EXTINGUISHERS

- A. Dry Chemical Type: Larsen's MP Series Model No. MP10- 10 LB Fire Extinguisher

2.3 FIRE EXTINGUISHER CABINETS

- A. Where indicated on drawings, provide Larsen's Architectural Series, Model Number SS-2409-R7 semi recessed with Vertical Duo Clear Tempered Safety Glass door. Door and trim to be fabricated from cold-rolled stainless steel. Special painted surfaces, color anodized aluminum, and graphics as indicated.

2.4 ACCESSORIES

- A. Provide Die Cut Lettering Black Vertical letters and recessed handle.

PART 3: EXECUTION

3.1 INSPECTION

- A. Verify that rough openings for cabinets are correctly sized and located.

3.2 INSTALLATION

- A. Install the items of this Section in strict accordance with the original design, approved shop drawings, and requirements of agencies having jurisdiction, as approved by the Architect, anchoring all components firmly into position.

END OF SECTION 104413

SECTION 105113 – SOLID PLASTIC WATERPROOF LOCKERS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

- A. Solid Plastic Wardrobe Lockers.
- B. Lockers shall be GREENGUARD Children & Schools Certified SM.

1.2 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Product Data: Manufacturer's standard details and catalog data indicating compliance with referenced standards, and manufacturer's installation instructions.
- C. Samples: 18 by 24 inches (150 by 150 mm) cut away sample door with provisions for lockset, hinge and corner section of frame.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Lockers shall be AQUAMAX HDPE Solid Plastic Wardrobe and Box Lockers as manufactured by Art Metal Products or approved equal. HDPE (high-density polyethylene) shall be of uniform color and texture. Fabricate lockers square, rigid and without warp. Lockers constructed of other materials, including materials with a core and not of solid plastic, will not be acceptable. Locker units will ship factory pre-assembled.
- B. Color: Door, body and accessory color to be selected from manufacturer's standard list of colors.
- C. Doors: Shall be fabricated of 1/2" thick HDPE. Doors shall be the full width of the locker and shall be frameless, allowing access to the entire width of the locker. Framed doors are unacceptable. Plain doors with perimeter ventilation shall provide ventilation properties superior to that of traditional framed doors.

- D. Body: Sides, tops, bottoms, back, and shelves shall be made from high impact, high density, polyethylene (HDPE) 3/8" thick and shall be white in color. Body incorporates mortise and tenon construction and shall be mechanically fastened together with stainless steel fasteners. Multiple width units will share intermediate sides and have unit width top, bottom, back and shelf/tier divider.
- E. Latch Assembly: The latching mechanism for wardrobe doors 20" high and higher shall be lift control type. Latching is achieved using an activation bar and multiple slide bars made of the same or similar materials as the locker body and doors and an additional 11-gauge type 304 stainless steel hasp mounted to the locker body that protrudes through door and aligns with lift handle. Box lockers 18" high and under include a single-point thru-the-door finger pull with 11-gauge type 304 stainless steel padlock hasp. All doors are prepared for use with a padlock
- F. Wardrobe Door Handle: Shall be made of injection molded HDPE or similar material and shall have an antimicrobial efficacy rating of 4.0 or greater. Handle shall move up and down in a vertical movement and shall require less than 5 lbs. of lifting force to operate in accordance with ADA requirements.
- G. Hinges: Shall be heavy-duty continuous full height extruded aluminum with a powder coating to match the locker door color. Hinge knuckles shall be separated with two nylon washers. Hinges shall be fastened to door and body with theft proof stainless steel fasteners.
- H. Accessories: end panels, fillers and base shall be manufactured of the same color, thickness and HDPE material as the locker doors.
- I. Equipment: Furnish each locker with the following items, unless otherwise noted:
1. Two tier locker openings 36 high locker openings shall include two single prong hooks fabricated of 11-gauge type 304 stainless steel attached to locker body with theft proof stainless steel hardware
 2. All lockers shall include an engraved aluminum number plate fastened to the door with theft proof fasteners.
- J. 20-Year Warranty: Art Metal Products AQUAMAX Plastic Lockers are covered against all defects in materials and workmanship excluding damage resulting from deliberate destruction and vandalism under this section for a period of 20 years.

END OF SECTION 105113

SECTION 113100 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Cooking equipment including free-standing ranges.
2. Ventilation range hoods.
3. Refrigerator.
4. Freezers.
5. Dishwasher
6. Undercounter Ice Maker
7. Garbage Disposal- (See Plumbing Drawings)

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Appliance Schedule: Use same designations indicated on Drawings.
- C. Maintenance data.

1.3 QUALITY ASSURANCE

- A. **Installer Qualifications:** An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.
- 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. **Gas-Burning Appliances:** Comply with ANSI Z21 Series standards.
- D. **Residential Appliances:** Comply with NAECA standards.
- E. **Energy Ratings:** Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer of each appliance specified agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.
1. Gas Range: Manufacturers Full Warranty..
 2. Refrigerator & Freezer: Manufacturers Full Warranty.
 3. Dishwasher: Manufacturers Full Warranty.
 4. Ice Maker: Manufacturers Full Warranty.
 - 5.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Basis-of-Design Product: The design for each residential appliance is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 COOKING APPLIANCES

- A. Range RG-: Freestanding, gas.
1. "IMPERIAL" Professional Restaurant Range, 8 Burner Model No. IR-8. BTU Gas Output is 310,000.
- B. Exhaust Wall Hood:
1. "WOLF" Professional Wall Hood/Chimney Model No. PW482418- 48" Wide. X 24" Deep. Provide 38" high stainless steel backsplash without warming racks. 30" High stainless steel duct cover. Provide 1200 CFM remote blower motor.
 2. Finish: Stainless steel.

2.3 REFRIGERATION APPLIANCES

- A. Refrigerator: Basis-of-Design Product:
1. "TRUE" "T" Series S.S. Reach In Solid Swing Doors, Refrigerator No. T-49 with casters.

2. Type: Freestanding, frost-free, two-door refrigerator.
3. Exterior Panel: Stainless-steel door front and side panels.

B. Freezer F- Basis-of-Design Product:

1. "TRUE" "T" Series S.S. Reach In Solid Swing Door Freezer No. T-23-HC with hydrocarbon refrigerant and casters.
2. Type: Freestanding, Frost-Free, One Door Freezer
3. Exterior Panel: Stainless-steel door front and side panels.

C. UNDERCOUNTER ICE-MAKER

1. Hoshizaki AM-50BAE-AD Air-Cooled ADA Compliant Ice Maker with S.S. Door

2.4 CLEANING APPLIANCES

A. Dishwasher DW:

1. "THERMADOR" Star-Sapphire 6 Program Dishwasher Model No. DWHD651JFP.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.
- B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- C. Utilities: Refer to Divisions 22 for plumbing and Division 26 for electrical requirements.

END OF SECTION 113100

NOT FOR BID

SECTION 11 33 00 - RETRACTABLE STAIRS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Manual disappearing stairways.

1.2 REFERENCES

- A. ANSI A14.9: Safety Requirements for Ceiling Mounted Disappearing Climbing Systems.

1.3 SUBMITTALS

- A. Submit under provisions of Section 013300.
- B. Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings for Stairs:
 - 1. Plan and section of stair installation.
 - 2. Indicate rough opening dimensions for ceiling and/or roof openings.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store stairway until installation inside under cover in manufacturer's unopened packaging. If stored outside, under a tarp or suitable cover.

1.5 WARRANTY

- A. Limited Warranty: One year against defective material and workmanship, covering parts only. Defective parts, as deemed by the manufacturer, will be replaced at no charge, freight excluded, upon inspection at manufacturer's plant.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Precision Ladders, LLC, P. O. Box 2279; Morristown, TN 37816-2279; Tel: 423-586-2265; Fax: 423-586-2091; www.PrecisionLadders.com

- B. Requests for substitutions will be considered in accordance with provisions of Section 016000.

2.2 MANUAL DISAPPEARING STAIRWAY.

- A. Manual Disappearing Stairway.
1. Standard Model: Super Simplex Disappearing Stairway with Deep Box Frame To Roof Hatch as manufactured by Precision Ladders LLC. Stairs for ceiling heights 7'-0" – 12'-0": Model 1000 (ceiling height in inches).
- B. Performance Standard: Unit shall comply with ANSI A14.9, Commercial Type, for rough openings between 27 inches to 39 inches. Residential Type for rough openings between 22-1/2" and 27". Stairway capacity shall be rated at 500 lbs.
- C. Accessories:
1. Steel pole to aid opening and closing stairways.
 2. Stairs for ceiling heights below 9' -9" shall be equipped with a patented Precision Fold Assist to aid in folding and unfolding of sections.
 3. Keyed lock for door (standard on fire-rated models, optional on non-fire-rated models).
- D. Components:
1. Ceiling Opening
 - a. Ceiling height of 9' 9" or less requires an opening of 30" x 54".
 2. Stairway Stringer: 6005-T5 Extruded aluminum channel 5" x 1" x 1/8"; tri-fold design; steel blade type hinges; adjustable feet with plastic Mar-guard. Pitch shall be 63°.
 3. Stairway Tread: 6005-T5 extruded aluminum channel 5 3/16 inches by 1 1/4 inches by 1/8 inch. Depth is 5 3/16 inches. Deeply serrated top surface. Riser Height: 9-1/2 inches. Clear Tread Width for Standard Width: 18 inches.
 4. Railing: Aluminum bar handrail riveted to stringers, upper section only.
 5. Frame:
 - a. If ceiling to floor (or roof deck) above is under 12", frame shall be 1/8" steel formed channel, box.
 - b. When ceiling to floor (or roof deck) above is 12" or greater, the frame shall be 1/8" steel, 63° (with built-in steps) on the hinge end, 90° on the other end, custom depth to fill distance from ceiling to floor above. This custom frame will require a longer opening in the floor above than is required at the ceiling level.
 6. Door Panel
 - a. Standard (non-fire rated) door shall be constructed of 1/8 inch (3 mm) aluminum sheet attached to stairway frame with a steel piano hinge. Door overlaps bottom flange of frame. Eye bolt accommodates pole for opening

and closing door.

- b. On fire-rated models, the door panel shall be constructed of 20 gauge steel and have a 2 hour fire rating for use in fire-rated ceiling assemblies as issued by Warnock-Hersey or other appropriate independent testing/licensing agency.

7. Hardware:

- a. Steel blade type hinge connecting stringer sections. Zinc plated and chromate sealed.
- b. Steel operating arms, both sides. Zinc coat with clear trivalent chromate.
- c. Double acting steel springs and cable, both sides.
- d. Rivets rated at 1100 lb (499 kg) shear strength each.
- e. Steel section alignment clips at stringer section joints.
- f. Molded rubber guards at corners of aluminum door panel.

8. Finishes: Mill finish on aluminum stairway components. Prime coat on frame.

2.3 FABRICATION

- A. Completely fabricate ladder ready for installation before shipment to the site.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until rough opening and structural support have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Examine materials upon arrival at site. Notify the carrier and manufacturer of any damage.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.3 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 113300

NOT FOR BID

SECTION 123560 – RESIDENTIAL CASEWORK

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. Wood-faced kitchen cabinets.
- B. Related Sections include the following:
 - 1. Division 06 Section Solid Surface Countertops for Kitchen Countertops.
 - 2. Division 11 Section Residential Appliances for appliances mounted in the kitchen casework.
 - 3. Division 22 Section Plumbing Fixtures for sink units mounted in countertops.

1.3 REFERENCES

- 1. American National Standards Institute (ANSI).
- 2. Builders Hardware Manufacturers Association (BHMA).
- 3. Hardwood Plywood & Veneer Association (HPVA).
- 4. Kitchen Cabinet Manufacturers Association (KCMA).
- 5. Laminating Materials Association (LMA).
- 6. National Electrical Manufacturers Association (NEMA).

1.4 DEFINITIONS

- A. Exposed Surfaces of Casework: Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinets or behind glass doors.
- B. Semi exposed Surfaces of Casework:
 - 1. Surfaces visible when behind opaque doors and drawer fronts are open, including interior faces of doors and interiors and sides of drawers.
 - 2. Bottoms of wall cabinets are defined as semi exposed.
- C. Concealed Surfaces of Casework:
 - 1. Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, and ends of cabinets installed directly against and completely concealed by walls or other cabinets.
 - 2. Tops of wall cabinets and utility cabinets are defined as concealed.

1.5 SUBMITTALS

- A. Product Data: For the Following:
 - 1. Cabinets.
 - 2. Cabinet hardware.
- B. Shop Drawings: For cabinets including plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, hardware, edge and backsplash profiles, cutouts for plumbing fixtures, and methods of joining countertops.
- C. Material Samples for Initial Selection: Manufacturer's color charts showing the full range of colors, textures, and patterns available for each type of material exposed to view.
- D. Material Samples for Verification: For the following materials; in sets showing full range of color, texture, and pattern variations expected:
 - 1. Solid wood with transparent finish, 50 sq. in. (300 sq. cm.), for each species.
 - 2. One unit of each type of exposed hardware.
- E. Product Samples for Verification: As Follows:
 - 1. One full-size, finished 15" base cabinet complete with hardware, doors, and drawers, but without countertop.
 - 2. One full sized, finished 15" wall cabinet complete with hardware, doors, and adjustable shelves.
- F. Product Certificates: Signed by manufacturers of casework certifying that products furnished comply with specified requirements.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Cabinets: Obtain cabinets through one source from a single manufacturer.
- B. Product Designations: Drawings indicate size, configurations, and finish material of casework by referencing designated manufacturer's catalog numbers. Other manufacturer's casework of similar sizes, similar door and drawer configurations, similar finish materials, and complying with the Specifications may be considered. Refer to Division 1 Section Substitutions.
- C. Quality Standards: Unless otherwise indicated, comply with the following standards:
 - 1. Cabinets: KCMA A161.1.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install residential casework until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

- B. Established Dimensions: Where residential casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Coordinate construction to ensure that the actual dimensions correspond to established dimensions. Provide fillers and scribes to allow for trimming and fitting.
- C. Field Measurements:
 - 1. For cabinets: Where residential casework is indicated to fit existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide filler and scribe if necessary.
 - 2. Field Measurements For Countertops: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 COORDINATION

- A. Coordinate layout installation of blocking and reinforcement in partitions for support of residential casework.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - 1. Merillat
 - 2. Sustainability Certifications: ISO14001, KCMA ESP & EPP.
- B. Acceptable Products: Subject to compliance with specified requirements, provide
 - 1. Merillat Classic Seneca Ridge Cherry (Delux) available in assorted finishes as selected by architect. Provide Wall (Arch) cabinet door design.
 - 2. Warranty: 25 years.

2.2 COLORS, TEXTURES, AND PATTERNS

- A. Colors, Textures, and Patterns: As indicated by referencing manufacturer's designations.
- B. Colors, Textures, and Patterns: As selected by Architect from manufacturer's full range for these characteristics.

2.3 CABINET MATERIALS

- A. Exposed Materials: Comply with the following:
 - 1. Exposed Wood Species:

- a. Unless otherwise indicated, do not use two adjacent exposed faces that are not similar and that are noticeably dissimilar in color, grain, figure, and or natural character markings.
 - b. Solid Cherry Wood.
- 2. Solid Wood: Clear hardwood lumber of species indicated, free of defects, selected for compatible grain and color, kiln dried to 7 percent moisture content.
- 3. Provide 3/4" thick Cherry Veneer End Panels.
- B. Semi-exposed Materials: Unless otherwise noted, provide the following:
 - 1. Medium Density Particleboard: Moisture- and stain-resistant, easy clean laminate with printed wood grain complying with ANSI A208.1, Grade M-1 adhesively bonded to particleboard.
 - a. Provide laminate film on both sides of shelves, dividers, and other components with two semi-exposed surfaces and semi-exposed edges.
- C. Concealed Materials: Comply with the following:
 - 1. Plywood: Any hardwood or softwood species, with no defects affecting strength or utility.
 - 2. Particleboard: ANSI A208.1, Grade M-1

2.4 CASEWORK HARDWARE

- A. General: Manufacturer's standard units complying with BHMA A156.9, type, material, size, and finish as selected from manufacturer's standard choices.
- B. Hinges: All doors shall be mounted on concealed, nickel-finished self-closing hinges. Door hinges will self-close within 10 degrees of cabinet face. All hinges shall have six-way (vertical, horizontal and front-to-back) adjustability except for 42" high WMGD, WGD, WCMGD, WCGD, WAMGD and WAGD wall Glass Door cabinets. All hinges have a LIMITED LIFETIME WARRANTY to the original purchaser.
- C. Drawer Guides: The 3/4 extension side-mount dual-captive roller drawer guide system shall be used on all standard Merillat drawers, roll-out trays and deep roll-out trays. The system shall consist of a pair of epoxy coated 1.25mm steel slides that roll on close-tolerance nylon wheels. All guides have a LIMITED LIFETIME WARRANTY to the original purchaser and comply with BHMA A156.9.

2.5 CABINET CONSTRUCTION

- A. Face Style: Reveal overlay: Door and drawer faces partially cover body or face frame.
- B. Face Frames: 3/4-by-1 1/2-inch (19-by-38mm) solid wood.
- C. Door and Drawer Fronts:
 - 1. Solid wood stiles and rails, 3/4-inch (19mm) thick, with 1/2-inch (12.7mm) thick, veneer-faced particleboard center panels.

2. Seneca Ridge doors are machined with reverse bevel to eliminate the need for hardware.
- D. Exposed Cabinet Ends:
1. 3/8-inch (9.5mm) thick, moisture- and stain-resistant, easy clean laminate faced particleboard.
- E. Cabinet Tops and Bottoms: Wall cabinet tops and bottoms shall be 1/2" thick-48 lb. density engineered wood. Both sides shall be covered with M-Guard™, with printed wood grain. The upper portion of base cabinets shall be reinforced with 1/2" thick engineered wood corner gussets in all four corners with adhesive which.
- G. Base Unit Back Panels: Base and bath cabinet back panels shall be 1/4"-thick 50 lb. density engineered wood covered on the interior surface only with M-Guard™, with printed wood grain.
- H. Wall-Hung Unit Backs: Wall cabinet back panels shall be 3/8" thick-48 lb. density engineered wood covered on the interior surface only with M-Guard™, with printed wood grain.
- I. Wall-Hung Unit Top and Bottom Rails: Wall cabinet backs shall be reinforced with a 2 3/4" wide x 3/8" thick-48 lb. density engineered wood full-length hang rail across the top and bottom held in place with staples. Additionally, shall be a 3/8" thick engineered wood spacer centered on the back panel rear side of cabinets 27" wide and wider secured with adhesive. Hang rails and spacer are fully concealed behind cabinet back panel.
- J. Front Face Frame Drawer Rails: Cabinet frames shall have 3/4" thick x 1 1/2" wide solid hardwood rail and stile members.
- K. Shelves: 3/4" thick-48 lb. density engineered wood. Full-depth shelves shall be covered on both sides with M-Guard™, matching the cabinet interior. Half-depth shelves are laminated on the top surface only and not on the underside. End panels are drilled for clear polycarbonate shelf supports on 2 1/2" increments. Shelves are designed to support 15 lbs. per square foot, not to exceed 50 lbs. per shelf.
- M. Joinery:
1. Wall cabinet back panels shall be retained by a dado in the end panels and secured with adhesive. For extra strength, full-length dadoes shall be machined in the back panel near the top and bottom edges like the dadoes in the end panels to accept the top panels and secured with adhesive and staples.
 2. Base cabinets: A dado joint and adhesive shall be used to join the bottom to end panels. The upper portion of base cabinets shall be reinforced with 1/2" thick engineered wood corner gussets.
 3. The back panel shall be retained by a dado in the end panels secured with adhesive. The top of base and bath cabinets shall have an 11/16" x 2 1/4" solid wood screw rail retained by the same groove as the back panel in the end panels and secured with adhesive. The screw rail shall be grooved full length on the underside to accept the top edge of the back panel.

- N. **Factory Finishing:** To the greatest extent possible, finish casework at the factory. Defer only final touch up until after installation.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install casework with no variations in flushness of adjoining surfaces; use concealed shims. Where casework abuts other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match casework face.
- B. Install casework without distortion so doors and drawers fit openings and are aligned. Complete installation of hardware and accessories as indicated.
- C. Install casework and countertop level and plumb to a tolerance of 1/8-inch in 8 feet (3mm in 2.4m).
- D. Fasten cabinets to adjacent units and to backing.
1. Fasten wall cabinets through back, near top and bottom, at ends and not less than 24 inches o. c.
- E. Protect finished surfaces from damage or staining resulting from subsequent work until Date of Substantial Completion. Repair or replace damaged cabinet work, including warped or loose members.

3.2 ADJUSTING AND CLEANING

A. **Touchup Painting:** Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. **Touchup Painting:** Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.

END OF SECTION 123560

SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes pipe, fittings, valves, and connections for sprinkler system.
- B. Related Sections:
 - 1. Division 03 - Concrete: Execution requirements for inserts and sleeves specified by this section.
 - 2. Division 09 - Finishes: Execution requirements for piping painting specified by this section.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
 - 2. ASME B16.11 - Forged Steel Fittings - Socket-Welding and Threaded.
 - 3. ASME B16.25 - Buttwelding Ends.
 - 4. ASME B16.3 - Malleable Iron Threaded Fittings.
 - 5. ASME B16.4 - Gray Iron Threaded Fittings.
 - 6. ASME B16.5 - Pipe Flanges and Flanged Fittings.
 - 7. ASME B16.9 - Factory-Made Wrought Steel Buttwelding Fittings.
- B. ASTM International:
 - 1. ASTM A47 - Standard Specification for Ferric Malleable Iron Castings.
 - 2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 3. ASTM A135 - Standard Specification for Electric-Resistance-Welded Steel Pipe.
 - 4. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
 - 5. ASTM A795 - Standard Specification for Black and Hot-Dipped Zinc-Coated (galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
- C. American Welding Society:
 - 1. AWS D1.1 - Structural Welding Code - Steel.
- D. American Water Works Association:
 - 1. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.

2. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 3. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
 4. AWWA C105 – Polyethylene Encasement for Ductile Iron Pipe Systems.
- E. National Fire Protection Association:
1. NFPA 13 - Installation of Sprinkler Systems.
 2. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
- C. Product Data: Submit manufacturers' catalogue information. Indicate valve data and ratings.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of components and tag numbering.
- C. Operation and Maintenance Data: Submit spare parts lists.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with NFPA 13 standard.
- B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 01 – General Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Product storage and handling requirements.
- B. Deliver and store valves in shipping containers, with labeling in place.
- C. Furnish cast iron and steel valves with temporary protective coating.
- D. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.9 WARRANTY

- A. Division 01 – General Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for basic fire suppression materials and methods.

1.10 EXTRA MATERIALS

- A. Division 01 – General Requirements: Spare parts and maintenance products.
- B. Furnish two sets of valve stem packing for each size and type of valve installed.

PART 2 - PRODUCTS

2.1 VALVES

- A. Manufacturers:
 - 1. Milwaukee.
 - 2. Stockham.
 - 3. Kennedy.
 - 4. Mueller.
 - 5. Substitutions: Division 01 – General Requirements - Product Requirements.
- B. Gate Valves:

1. Up to and including 2 inches: Bronze body and trim, rising stem, hand wheel, solid wedge or disc, threaded ends. Similar to Stockham Model No. B-133.
 2. Over 2 inches: Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, hand wheel, OS&Y, solid bronze or cast iron wedge, flanged ends. Similar to Stockham Model No. G-634.
- C. Globe or Angle Valves:
1. Up to and including 2 inches: Bronze body, bronze trim, rising stem and hand wheel, inside screw, renewable Buna n Seat disc, threaded ends, with back seating capacity. Similar to Kennedy Model No. 98-SD.
- D. Ball Valves:
1. Up to and including 2 inches: Bronze two piece body, brass, chrome plated bronze, or stainless steel ball, teflon seats and stuffing box ring, lever handle, threaded ends. Similar to Kennedy Model No. 775.
- E. Butterfly Valves:
1. Bronze Body: Stainless steel disc, resilient replaceable seat, threaded or grooved ends, extended neck, hand wheel and gear drive and integral indicating device , and built-in tamper proof switch rated 10 amp at 115 volt AC.
 2. Cast or Ductile Iron Body: Cast or ductile iron, chrome or nickel plated ductile iron or aluminum bronze disc, resilient replaceable EPDM seat, wafer, lug, or grooved ends. With extended neck, hand wheel and gear drive and integral indicating device, and external tamper switch rated 10 amp at 115 volt AC.
- F. Check Valves:
1. Up to and including 2 inches: Bronze body and swing disc, rubber seat, threaded ends. Similar to Stockham Model No. B-319Y.
 2. Over 2 inches: Iron body, bronze trim, swing check, renewable disc and seat, flanged ends. Similar to Stockham Model No. G-939.
 3. 4 inches and Over: Iron body, bronze disc with stainless steel spring, resilient seal, threaded, wafer, or flanged ends.

2.2 BURIED PIPING

- A. Double Iron: AWWA C151.
1. Fittings: AWWA C110, ductile iron standard thickness.
 2. Joints: AWWA C111, rubber gasket.
 3. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.
 4. Jackets: AWWA C105, polyethylene jacket for corrosive soils.

2.3 ABOVE GROUND PIPING

- A. Steel Pipe: ASTM A53/A53M, Grade B; ASTM A135; ASTM A135 UL listed, threadable, light wall for mains larger than 2 inch; or ASTM A795; Schedule 40 black, outside applications shall be galvanized pipe. Pipes shall have a corrosion resistance ratio (CRR) of 1.00 or greater per UL listing. Piping shall be black carbon steel, except in FM approved dry systems, where pipe shall be hot-dipped galvanized to meet ASTM A795 zinc coating specifications. Pipe shall be Schedule 40 or equal; for 2 inches and smaller. Threaded joints and fittings. Schedule 10 for pipes size 2-1/2 inches or larger. Victaulic or grooved fittings may be used.
1. Steel Fittings: ASME B16.9, wrought steel, butt welded; ASME B16.25, butt weld ends; ASTM A234/A234M, wrought carbon steel and alloy steel; ASME B16.5, steel flanges and fittings; or ASME B16.11, forged steel socket welded and threaded.
 2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings; or ASME B16.4, threaded fittings.
 3. Malleable Iron Fittings: ASME B16.3, threaded fittings or ASTM A47.

2.4 PIPE HANGERS AND SUPPORTS

- A. Conform to NFPA 13.
- B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
- C. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
- D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- E. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.
- F. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.
- G. Vertical Support: Steel riser clamp.
- H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.

- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

- A. Install piping in accordance with NFPA 13 for sprinkler systems and NFPA 24 for service mains.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- C. Install piping to conserve building space, to not interfere with use of space and other work.
- D. Group piping whenever practical at common elevations.
- E. Pipe through floors, wall, and ceilings, at head locations, shall be equipped with approved sleeves and escutcheons. Escutcheons shall be polished chrome plated.
- F. Install pipe sleeve at piping penetrations through footings, walls, and floors. Seal pipe and sleeve penetrations to maintain fire resistance equivalent to fire separation.
- G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- H. Pipe Hangers and Supports:
 - 1. Install in accordance with NFPA 13.
 - 2. Install hangers to with minimum 1/2 inch space between finished covering and adjacent work.
 - 3. Place hangers within 12 inches of each horizontal elbow.
 - 4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 5. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
 - 6. Where installing several pipes in parallel and at same elevation, provide multiple or trapeze hangers.
 - 7. Prime coat exposed steel hangers and supports. Refer to Section 099000. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- I. Slope piping and arrange systems to drain at low points. Install eccentric reducers to maintain top of pipe level.

- J. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding. Refer to Section 099000.
- K. Do not penetrate building structural members unless indicated.
- L. Where more than one piping system material is specified, install compatible system components and joints. Install flanges, union, and couplings at locations requiring servicing.
- M. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.
- N. Install valves with stems upright or horizontal, not inverted. Remove protective coatings after installation.
- O. Install gate or butterfly valves for shut-off or isolating service.
- P. Install drain valves at main shut-off valves, low points of piping and apparatus.
- Q. Sprinkler system shall be provided with complete drainage facilities in accordance with UBC Std drain discharge shall not spill on grade. It shall go into a sewer.
- R. Where inserts are omitted, drill through concrete slab from below and install through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.
- S. Upon completion and prior to acceptance of installation, Contractor shall subject system, including underground supply connections, to tests required by UBC Std and shall furnish the District with a certificate of compliance as required.
- T. Close nipples shall not be used. Threaded unions shall not be installed in concealed areas unless provided with an approved access panel.
- U. Fire sprinkler systems piping hanger and supports shall conform to the UBC Std requirements.
- V. Underground pipe shall be laid on a flat undisturbed sand bed. After required pressure-leak test, pipe shall be covered with sand not less than 6 inches thick, prior to backfilling.
- W. Piping to a sprinkler head in the elevator machine room or elevator shaft shall not go out of the room or shaft.

- X. Provide shunt trip on sprinklers located in the elevator machine rooms and elevator hoist way unless the sprinklers are located 2 feet or less from the pit floor.

3.3 INTERFACE WITH OTHER PRODUCTS

- A. Inserts:
 - 1. Install inserts for placement in concrete forms.
 - 2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Install hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

3.4 CLEANING

- A. Division 01 – General Requirements: Final cleaning.
- B. Clean entire system after other construction is complete.

END OF SECTION 210500

SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes wet-pipe sprinkler system, system design, installation, and certification.
- B. Related Sections:
 - 1. Division 09 - Finishes: Paints and Coatings.
 - 2. Section 260503 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this section.
 - 3. Section 312316: Excavation.

1.2 REFERENCES

- A. National Fire Protection Association:
 - 1. NFPA 13 - Installation of Sprinkler Systems.

1.3 SYSTEM DESCRIPTION

- A. Section Includes: Furnish and install fire sprinkler system for protection of all required areas of the entire building including attic and between floor spaces unless otherwise indicated. Items required for this work include but are not limited to:
 - 1. Automatic wet pipe fire sprinkler system.
 - 2. Preparation of complete shop installation drawings for the fire sprinkler systems and approvals.
 - 3. Required permits, licenses and inspections.
 - 4. Cleaning, testing and adjusting.
 - 5. Project record documents of work as installed.
- B. Provide hydraulically designed system to NFPA 13 occupancy requirements.
 - 1. Hydraulic calculations shall be based on a format acceptable to the State Fire Marshal and the City or County fire authority. Calculations shall be performed utilizing no more than 90 percent of the minimum available water supply.
 - 2. Approval by the fire authorities may cover minimum legal requirements and does not supersede more extensive contractual requirements.
- C. Determine volume and pressure of incoming water supply from water flow test data.
- D. Interface system with building fire and smoke alarm system.
- E. Provide fire department connections as indicated on Drawings.

1.4 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Shop Drawings: Indicate layout of finished ceiling areas indicating sprinkler locations coordinated with ceiling installation. Indicate detailed pipe layout, hangers and supports, seismic restraint details, sprinklers, components and accessories.
 - 1. Shop drawings shall be prepared and be signed by a licensed fire protection engineer of the State of California.
 - 2. Installation of fire sprinkler system shall not start until approved drawings have been returned to Contractor by the architect. Alignment of fire sprinklers and relationship to ceiling tile locations shall be as approved by the architect.
- C. Product Data: Submit data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- D. Design Data: Submit design calculations; signed and sealed by professional engineer.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations. Record prints as installed shall be kept current on site, available for Fire Inspector and the District Inspector to review. At completion of installation, record prints shall be signed by installer and delivered to the architect for correcting tracings to record drawing status.
- C. Operation and Maintenance Data: Submit components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

1.6 QUALITY ASSURANCE

- A. Standards: Comply with applicable national or local codes and standards: ASTM, ASME, ANSI, IAPMO, Federal Specifications, MSS Specifications, AWWA, CISPI, NFPA, FM, UL, UPC, UMC.
- B. Unless otherwise noted, provisions of NFPA 13, Standard for Installation of Sprinkler Systems, are made part of this section.

- C. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.
- C. Design system under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of California.

1.8 PRE-INSTALLATION MEETINGS

- A. Division 01 – General Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Product storage and handling requirements.
- B. Store products in shipping containers until installation.
- C. Deliver and store valves in shipping containers with labeling in place.
- D. Provide temporary protective coating on cast iron and steel valves.
- E. Furnish piping with temporary inlet and outlet caps until installation.

1.10 WARRANTY

- A. Division 01 – General Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for all valves.

1.11 EXTRA MATERIALS

- A. Division 01 – General Requirements: Spare parts and maintenance products.
- B. Furnish extra sprinklers under provisions of NFPA 13.
- C. Furnish suitable wrenches for each sprinkler type.
- D. Furnish metal storage cabinet located adjacent to alarm valve or as directed by the Inspector.

PART 2 - PRODUCTS

2.1 SPRINKLERS

- A. Manufacturers:
1. Ansul Incorporated.
 2. Automatic Sprinkler Corp.
 3. Grinnell Corp.
 4. Reliable Sprinkler Corp.
 5. Substitutions: Division 01 – General Requirements - Product Requirements.
- B. Suspended and Hard Lid Ceiling Type:
1. Type: Recessed or Concealed pendant type with matching push on or screw on escutcheon plate as directed by the architect.
 2. Finish: Chrome plated, or Enamel, color white as directed by the Architect.
 3. Escutcheon Plate Finish: Chrome plated or Enamel, color white as directed by the Architect.
 4. Fusible Link: Quick response, glass bulb type temperature rated for specific area hazard.
 5. Similar to Reliable Model No. FIFR or G4A.
- C. Exposed Area Type:
1. Type: Standard upright type with guard as required.
 2. Finish: Brass.
 3. Fusible Link: Quick response glass bulb type temperature rated for specific area hazard.
 4. Similar to Reliable Model No. FIFR.
- D. Side wall Type:
1. Type: Standard or Recessed horizontal side wall type with matching push on or screw on escutcheon plate as directed by the Architect.
 2. Finish: Chrome plated, enamel, color white, as directed by the Architect.
 3. Escutcheon Plate Finish: Chrome plated or Enamel, color white as directed by the Architect.
 4. Fusible Link: Quick response glass bulb type temperature rated for specific area hazard.
 5. Similar to Reliable Model No. SW56.
- E. Guards: Finish to match sprinkler finish.

2.2 PIPING SPECIALTIES

- A. Wet Pipe Sprinkler Alarm Valve: Check type valve with EPDM seat, clapper to automatically actuate water motor alarm, with pressure retard chamber and variable pressure trim similar to Reliable Model No. G.
- B. Sprinkler Inspector's Test Fittings:

1. Standard: UL's listed or FM Global approved.
 2. Pressure Rating: 3000 psig.
 3. Body Material: Bronze body, brass stem, steel handle, chrome-plated bronze ball, virgin Teflon valve seat. Sight Glass: Bronze housing with viewing window.
 4. Components: A tamper resistant test orifice and a tapped port for system access.
 5. Test Orifice Size: Nominal 1/2" as required by NFPA.
 6. Size: F.I.P.T., same as connected piping.
 7. Inlet and Outlet: Threaded.
 8. Similar to AGF Model No. 3011SG.
- C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC. Similar to Potter Electric Model No. VSR.
- D. Fire Department Connections:
1. Type: Flush mounted wall type with chrome plated finish.
 2. Outlets: Two-way with fire department thread size. Threaded dust-cap and chain of matching material and finish.
 3. Drain: 3/4 inch automatic drip, outside.
 4. Label: "Sprinkler - Fire Department Connection"
 5. Similar to Potter Roemer Model No. 5021F.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with NFPA 13.
- B. Install buried shut-off valves in valve box. Furnish post indicator.
- C. Install Fire Department connections, check valves, shut-off valves, test and drain assemblies and flow indicator as required.
- D. Locate outside alarm-gong on building wall as indicated on Drawings or as required by the authority having jurisdiction.
- E. Place pipe runs to minimize obstruction to other work.
- F. Install piping in concealed spaces above finished ceilings.
- G. Center sprinklers in two directions in ceiling tile and install piping offsets.
- H. Install guards on sprinklers as required by NFPA 13.
- I. Hydrostatically test entire system.
- J. Require test be witnessed by authority having jurisdiction.

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Verify signal devices are installed and connected to fire alarm system.

3.3 CLEANING

- A. Flush entire piping system of foreign matter.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

- A. Apply masking tape or paper cover to protect concealed sprinklers, cover plates, and sprinkler escutcheons not receiving field paint finish. Remove after painting. Replace painted sprinklers with new.

3.5 SYSTEM TESTS

- A. For pressure test, use a hydrostatic pressure of 50 psi greater than the maximum working pressure of the system, except that for those portions of the system having pipe size larger than 2 inches in diameter, hydrostatic test pressure shall be not less than 200 psi. Hold this pressure not less than 2 hours. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For leakage test, use a hydrostatic pressure not less than the maximum pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test. Repair all leaks and replace piping, fittings and other system components as required, at no additional cost to the Owner.
- B. Test shall be witnessed by authority having jurisdiction and Architect.

END OF SECTION 211313

SECTION 220503 - PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Pipe and pipe fittings for the following systems:
1. Domestic water piping, within 5 feet of building.
 2. Domestic water piping, above grade.
 3. Sanitary sewer piping, within 5 feet of building.
 4. Sanitary sewer piping, above grade.
 5. Storm water piping, within 5 feet of building.
 6. Storm water piping, above grade.
 7. Equipment drains and over flows.
 8. Gas seismic valves.
 9. Flexible connectors.
 10. Unions and flanges.
 11. Underground pipe markers.
 12. Bedding and cover materials.
- B. Related Sections:
1. Division 07 – Thermal and Moisture Protection: Product requirements for firestopping for placement by this section.
 2. Division 08 - Openings: Product requirements for access doors for placement by this section.
 3. Division 09 - Finishes: Product and execution requirements for painting specified by this section.
 4. Section 220523 - General-Duty Valves for Plumbing Piping: Product requirements for valves for placement by this section.
 5. Section 220529 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports and firestopping for placement by this section.
 6. Section 220700 - Plumbing Insulation: Product requirements for piping insulation for placement by this section.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
1. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
 2. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 3. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
 4. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.
- B. ASTM International:

1. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings.
 2. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 3. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
 4. ASTM A888 – Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
 5. ASTM B32 - Standard Specification for Solder Metal.
 6. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
 7. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).
 8. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
 9. ASTM D1248 – Standard Specification for Polyethylene Plastics Molding and Extrusion Material.
- C. American Welding Society:
1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
- D. American Water Works Association:
1. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
 2. AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
 3. AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 4. AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
- E. Cast Iron Soil Pipe Institute:
1. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
 2. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, and sizes. Submit shop drawings sealed by registered professional engineer.
- C. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

- D. Design Data: Indicate pipe sizes. Indicate pipe sizing methods. Indicate calculations used. Submit sizing methods and calculations sealed by registered professional engineer.
- E. Welders' Certificate: Include welders' certification of compliance with ASME Section IX.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.
- B. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum 5 years documented experience approved by manufacturer.
- C. Design piping systems with pipe hangers and supports under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of California.

1.6 PRE-INSTALLATION MEETINGS

- A. Division 01 – General Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 – General Requirements: Environmental conditions affecting products on site.
- B. Do not install underground piping when bedding is wet or frozen.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 COORDINATION

- A. Division 01 – General Requirements: Requirements for coordination.
- B. Coordinate installation of buried piping with trenching.

PART 2 - PRODUCTS

2.1 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Ductile Iron Pipe: AWWA C151 with cement lining as per AWWA, C104.
 - 1. Fittings: AWWA C110, ductile iron, standard thickness.
 - 2. Joints: AWWA C111, rubber gasket with rods.
 - 3. Jackets: AWWA C105 polyethylene jacket].
- B. Copper Tubing: ASTM B88, Type K annealed.
 - 1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
 - 2. Joints: Compression connection or Brazed, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.2 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tubing: ASTM B88, Type L, hard drawn.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

2.3 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Soil Pipe: ASTM A888 plain ends.
 - 1. Fittings: Cast iron, ASTM A888.
 - 2. Joints: CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.
 - 3. Acceptable Manufacturers: ABI, Charlotte and Tyler Pipe.
- B. Cast Iron Pipe: CISPI 301, hub-less.
 - 1. Fittings: Cast iron, CISPI 301.
 - 2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.
 - 3. Acceptable Manufacturers: ABI, Charlotte and Tyler Pipe.

- C. Polyethylene Encasement: ASTM D1248 polyethylene tube or sheet form to encase cast iron pipe, with minimum 0.008 inch (0.20 mm) thickness. Install encasement as per ASTM A74 and manufacturer's recommendations.

2.4 SANITARY SEWER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A888, service weight.
 - 1. Fittings: Cast iron, ASTM A888.
 - 2. Joints: ASTM C564, rubber gasket joint devices or lead and oakum.
 - 3. Acceptable Manufacturers: ABI, Charlotte and Tyler Pipe.
- B. Cast Iron Pipe: CISPI 301, hub-less, service weight.
 - 1. Fittings: Cast iron, CISPI 301.
 - 2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.
 - 3. Acceptable Manufacturers: ABI, Charlotte and Tyler Pipe.
- C. Copper Tube: ASTM B306, DWV.
 - 1. Fittings: ASME B16.23, cast bronze, or ASME B16.29, wrought copper.
 - 2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.

2.5 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A888, plain ends.
 - 1. Fittings: Cast iron, ASTM A888.
 - 2. Joints: ASTM C564, rubber gasket joint devices or lead and oakum.
 - 3. Acceptable Manufacturers: ABI, Charlotte and Tyler Pipe.
- B. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron, CISPI 301.
 - 2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.
 - 3. Acceptable Manufacturers: ABI, Charlotte and Tyler Pipe.
- C. Polyethylene Encasement: ASTM D1248 polyethylene tube or sheet form to encase cast iron pipe, with minimum 0.008 inch (0.20 mm) thickness. Install encasement as per ASTM A74 and manufacturer's recommendations.

2.6 STORM WATER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A888 plain ends.
 - 1. Fittings: Cast iron, ASTM A888.
 - 2. Joints: ASTM C564, neoprene gasket system or lead and oakum.
 - 3. Acceptable Manufacturers: ABI, Charlotte and Tyler Pipe.
- B. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron, CISPI 301.

2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.
3. Acceptable Manufacturers: ABI, Charlotte and Tyler Pipe.

2.7 EQUIPMENT DRAINS AND OVERFLOWS

- A. Copper Tubing: ASTM B88, Type DWV, hard drawn.
 1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
 2. Joints: Solder, lead free, ASTM B32, 95-5 tin-antimony, or tin and silver, with melting range 430 to 535 degrees F.
- B. Pre Schedule AD: ASTM 1885.
 1. Fittings: ASTM O2665, ASTM F794, ASTM F1866.

2.8 GAS SEISMIC VALVES

- A. SGV-1: Provide a valve consisting of a swing check valve arrangement with an acceleration-sensitive triggering mechanism. The trip mechanism shall consist of a steel ball resting on a tapered cup-shaped support. The trip mechanism shall be factory set and sealed. A sight glass is provided so that the Open or Closed indicator can be seen, and the trip mechanism status of the valve can be easily determined. The valve assembly shall be certified by the California State Architect's Office, approved by the local authority, meet the requirements of ANSI Z21.70 and ASCE 25-97. See Schedule for Model number.

2.9 FLEXIBLE CONNECTORS

- A. Manufacturers:
 1. Flex-Hose Co., Inc.
 2. Flex-Weld, Inc./Keflex.
 3. The Metraflex Company.
 4. Twin City Hose, Inc.
 5. USHose Corp.
 6. Substitutions: Section 016000 - Product Requirements.
- B. 2 inches and Smaller: Corrugated stainless steel hose with single layer of stainless steel exterior braiding, copper tubing ends; maximum working pressure 170 psig, threaded or soldered connections.
- C. 2-1/2 inches and Larger: Corrugated stainless steel hose with single layer of stainless steel exterior braiding, Class 150 flanged ends; maximum working pressure 190 psig.

2.10 UNIONS AND FLANGES

- A. Unions for Pipe 2 inches and Smaller:
 1. Ferrous Piping: Class 150, malleable iron, threaded.
 2. Copper Piping: Class 150, bronze unions with soldered.

3. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
- B. Flanges for Pipe 2-1/2 inches and Larger:
 1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
 2. Copper Piping: Class 150, slip-on bronze flanges.
 3. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.11 UNDERGROUND PIPE MARKERS

- A. Manufacturers:
 1. Section.
 2. Brady.
 3. Substitutions: Division 01 – General Requirements - Product Requirements.
- B. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
- C. Trace Wire: Magnetic detectable conductor, bare.

2.12 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Plumbing drawing notes 49 and 50 on Sheet P-0.1.
- B. Cover: As specified in Plumbing drawing notes 49 and 50 on Sheet P-0.1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Verification of existing conditions before starting work.
- B. Verify excavations are to required grade, dry, and not over-excavated.
- C. Verify trenches are ready to receive piping.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

- A. Verify connection size, location, and invert are as indicated on Drawings.
- B. Establish elevations of buried piping with not less than 1 ft of cover.
- C. Establish minimum separation of 1 foot from other services piping in accordance with CPC code.
- D. Install pipe to elevation as indicated on Drawings or as required.
- E. Install pipe on prepared bedding.
- F. Route pipe in straight line.
- G. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- H. Install shutoff and drain valves at locations indicated on Drawings in accordance with this Section.
- I. Install plastic ribbon tape continuous over top of pipe, 6 inches above pipe line.
- J. Install trace wire continuous over top of pipe, 6 inches above pipe line.
- K. Pipe Cover and Backfilling:
 - 1. Maintain optimum moisture content of fill material to attain required compaction density.
 - 2. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 12 inches minimum cover over top of jacket. Compact to 95 percent maximum density.
 - 3. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
 - 4. Do not use wheeled or tracked vehicles for tamping.

3.4 INSTALLATION - ABOVE GROUND PIPING

- A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
- C. Group piping whenever practical at common elevations.

- D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 220529.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 220700.
- G. Provide clearance for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors with Division 08.
- I. Install non-conducting dielectric connections wherever jointing dissimilar metals.
- J. Establish invert elevations, slopes for drainage to $\frac{1}{4}$ inch per foot minimum. Maintain gradients unless otherwise indicated.
- K. Slope piping and arrange systems to drain at low points.
- L. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.
- M. Where pipe support members are welded to structural building framing, scrape, brush clean and apply one coat of zinc rich primer to welding.
- N. Prepare pipe, fittings, supports and accessories not prefinished, ready for finish painting.
- O. Install valves with stems upright or horizontal, not inverted.
- P. Provide one plug cock wrench for every ten plug cocks sized 2 inches and smaller, minimum of one. Provide each plug cock sized 2-1/2 inches and larger with a wrench with set screw.
- Q. Provide firestopping at fire rated walls, floors or ceiling assemblies under provisions of Division 7.
- R. Install piping penetrating roofed areas to maintain integrity of roof assembly.
- S. Install valves in accordance with Section 220523.
- T. Insulate piping. Refer to Section 220700.

3.5 INSTALLATION - DOMESTIC WATER PIPING SYSTEMS

- A. Install domestic water piping system in accordance with CPC.

3.6 INSTALLATION - SANITARY WASTE AND VENT PIPING SYSTEMS

- A. Install sanitary waste and vent piping systems in accordance with CPC.

3.7 INSTALLATION - STORM DRAINAGE PIPING SYSTEMS

- A. Install storm drainage piping systems in accordance with CPC plumbing code.
- B. Support cast iron drainage piping at every joint.

3.8 APPLICATION

- A. Install unions downstream of valves and at equipment or apparatus connections.
- B. Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.
- C. Install ball valves for shut-off and to isolate equipment or part of system. Install access panel in hard ceilings and or walls as indicated on plans.
- D. Install globe or ball valves for throttling, bypass or manual flow control services. Install access panel in hard ceilings and or walls as indicated on plans.

3.9 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Test domestic water piping system in accordance with applicable code.
- C. Test sanitary waste and vent piping system in accordance with applicable code.
- D. Test storm drainage piping system in accordance with applicable code.

3.10 CLEANING

- A. Division 01 – General Requirements: Requirements for cleaning.

3.11 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfection of potable water system shall comply with ANSI/AWWA C651-92.
- B. When hot and cold water piping, including fixtures, have been installed, tested and accepted. Disinfect the system using any of the three methods of chlorination explained in AWWA C651-92 standard.
- C. The basic disinfection procedure shall consists of:
 - 1. Preventing contaminating materials from entering the water piping system during storage, construction or repair.

2. Removing, by flushing or other means, those materials that may have entered the water piping system.
 3. Chlorinating any residual contamination that may remain, and flushing the chlorinated water from the piping system.
 4. Protecting the existing distribution system from backflow due to hydrostatic pressure test and disinfection procedures.
 5. Determining the bacteriological quality by laboratory test after disinfection. At least one water sample from the existing distribution system shall be tested.
 6. Final connection of the water piping system to the active distribution system.
- D. Submit Record of Compliance: The record of compliance shall be the bacteriological test results certifying the water sampled from the water piping system to be free of coliform bacteria contamination, and to be equal to or better than the bacteriologic water quality in the distribution system.

END OF SECTION 220503

NOT FOR BID

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Ball valves.
 - 2. Check valves.
 - 3. Gas ball valves.
 - 4. Gas cocks.
 - 5. Pressure reducing valves.
- B. Related Sections:
 - 1. Section 220503 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
 - 2. Section 220529 - Hangers and Supports for Plumbing Piping and Equipment: Product and installation requirements for pipe hangers and supports.
 - 3. Section 220700 - Plumbing Insulation: Product and installation requirements for insulation for valves.

1.2 REFERENCES

- A. Manufacturers Standardization Society of the Valve and Fittings Industry:
 - 1. MSS SP 68 – High Pressure – Offset Seat Butterfly Valves.
 - 2. MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.
 - 3. MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.
 - 4. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
 - 5. MSS SP 125 – Gray Iron and Ductile Iron In-line, Spring Loaded, Center-Guided Check Valves.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Requirements for submittals.
- B. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.
- C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of valves.
- C. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.5 QUALITY ASSURANCE

- A. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 01 – General Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 – General Requirements: Environmental conditions affecting products on site.
- B. Do not install valves underground when bedding is wet or frozen.

1.10 WARRANTY

- A. Division 01 – General Requirements: Requirements for warranties.
- B. Furnish five year manufacturer warranty for valves excluding packing.

1.11 EXTRA MATERIALS

- A. Division 01 – General Requirements: Requirements for extra materials.
- B. Furnish two packing kits for each size valve.

PART 2 - PRODUCTS

2.1 BALL VALVES

- A. Manufacturers:
 - 1. Crane Valve, North America.
 - 2. Milwaukee Valve Company.
 - 3. NIBCO, Inc.
 - 4. Stockham Valves & Fittings.
 - 5. Substitutions: Section 016000 - Product Requirements.
- B. 2 inches and Smaller: MSS SP 110, 600 psi WOG, two-piece bronze body, 316 stainless steel ball full port, PTFE seats, blow-out proof stem, threaded ends, lever handle. Similar to Nibco Model T-580-70-66

2.2 CHECK VALVES

- A. Horizontal Swing Check Valves:
 - 1. Manufacturers:
 - a. Crane Valve, North America.
 - b. Milwaukee Valve Company.
 - c. NIBCO, Inc.
 - d. Stockham Valves & Fittings.
 - e. Substitutions: Section 016000 - Product Requirements.
 - 2. 2 inches and Smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, bronze disc, solder or threaded ends. Similar to Nibco Model T-433.
 - 3. 2-1/2 inches and Larger: MSS SP 71, Class 125, cast iron body, bolted cap, bronze or cast iron disc, renewable disc seal and seat, flanged ends. Similar to Nibco Model F-918-B.

2.3 GAS BALL VALVES

- A. 1/4 inch to 1 inch: MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids and LPG, full port.
- B. 1-1/4 inch to 3 inch: MSS SP 110, Class 125, two piece, threaded ends, bronze body, chrome plated bronze ball, reinforced teflon seats, blow-out proof stem, lever handle, UL 842 listed for flammable liquids and LPG, conventional port.

2.4 GAS COCKS

- A. Up to 2 Inches: Bronze body, bronze tapered plug, non-lubricated, Teflon packing, threaded ends.
- B. Over 2 Inches: Cast iron body and plug, non-lubricated, Teflon packing, flanged ends.
- C. Similar to Conbraco Model 50.

2.5 PRESSURE REDUCING VALVE

- A. The pressure reducing valve shall consist of a cast bronze body and bell housing and a "Y" strainer with 20 mesh stainless steel screen. A separate access cover for the plunger and a bolt to adjust the downstream pressure shall be provided. The bronze bell housing and access cap shall be threaded to the body and shall not require the use of ferrous screws. The assembly shall be of the balanced piston design and shall reduce pressure in both flow and no-flow conditions. The assembly shall be accessible to maintenance without having to remove the body from the line.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Verification of existing conditions before starting work.
- B. Verify piping system is ready for valve installation.

3.2 INSTALLATION

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- C. Install 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.
- D. Install valves with clearance for installation of insulation and allowing access.
- E. Provide access where valves and fittings are not accessible.
- F. Refer to Section 220529 for pipe hangers.
- G. Refer to Section 220700 for insulation requirements for valves.

- H. Refer to Section 220503 for piping materials applying to various system types.
- I. For installation of valves in compressed air piping systems refer to Section 221500.

3.3 VALVE APPLICATIONS

- A. Install ball for shut-off and to isolate equipment, part of systems, or vertical risers.
- B. Install ball valves in domestic water systems for shut-off service.

END OF SECTION 220523

NOT FOR BID

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Pipe hangers and supports.
 2. Hanger rods.
 3. Inserts.
 4. Flashing.
 5. Sleeves.
 6. Mechanical sleeve seals.
 7. Formed steel channel.
 8. Firestopping relating to plumbing work.
 9. Firestopping accessories.
 10. Equipment bases and supports.
- B. Related Sections:
1. Division 03 - Concrete: Execution requirements for placement of inserts sleeves in concrete forms specified by this section.
 2. Division 03 - Concrete: Execution requirements for placement of concrete housekeeping pads specified by this section.
 3. Division 07 - Thermal and Moisture Protection: Product requirements for firestopping for placement by this section.
 4. Division 07 - Thermal and Moisture Protection: Product requirements for sealant materials for placement by this section.
 5. Division 09 - Finishes: Product and execution requirements for painting specified by this section.
 6. Section 220503 - Pipes and Tubes for Plumbing Piping and Equipment: Execution requirements for placement of hangers and supports specified by this section.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
1. ASME B31.1 - Power Piping.
 2. ASME B31.9 - Building Services Piping.
- B. ASTM International:
1. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
 2. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
 3. ASTM E814 - Test Method of Fire Tests of Through Penetration Firestops.
 4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

- 5. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
- C. American Welding Society:
 - 1. AWS D1.1 - Structural Welding Code - Steel.
- D. FM Global:
 - 1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.
- E. Manufacturers Standardization Society of the Valve and Fittings Industry:
 - 1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
 - 2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
 - 3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- F. Underwriters Laboratories Inc.:
 - 1. UL 263 - Fire Tests of Building Construction and Materials.
 - 2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
 - 3. UL 1479 - Fire Tests of Through-Penetration Firestops.
 - 4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
 - 5. UL - Fire Resistance Directory.
- G. Intertek Testing Services (Warnock Hersey Listed):
 - 1. WH - Certification Listings.

1.3 DEFINITIONS

- A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

- A. Firestopping Materials: ASTM E119, ASTM E814, UL 263 and UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.
- B. Surface Burning: ASTM E84, UL 723 with maximum flame spread / smoke developed rating of 25/450.
- C. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

- A. Firestopping: Conform to FM or UL for fire resistance ratings and surface burning characteristics.

- B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.
- C. Product Data:
 - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
 - 2. Firestopping: Submit data on product characteristics, performance and limitation criteria.
- D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
- E. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers. Submit sizing methods and calculations sealed by a registered professional engineer.
- F. Manufacturer's Installation Instructions:
 - 1. Hangers and Supports: Submit special procedures and assembly of components.
 - 2. Firestopping: Submit preparation and installation instructions.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- H. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

- A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - 1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
 - 2. Floor Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

- B. Through Penetration Firestopping of Non-Fire Rated Floor Assemblies: Materials to resist free passage of flame and products of combustion.
 - 1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
 - 2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.
- C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.
- D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.
- E. Surface Burning Characteristics: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- F. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.
- G. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum 3 years documented experience.

1.9 PRE-INSTALLATION MEETINGS

- A. Division 01 – General Requirements: Pre-installation meeting.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 – General Requirements: Environmental conditions affecting products on site.
- B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.
- C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

1.12 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.13 WARRANTY

- A. Division 01 – General Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for pipe hangers and supports.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. Carpenter & Paterson Inc.
 - 2. Creative Systems Inc.
 - 3. Flex-Weld, Inc.
 - 4. Glope Pipe Hanger Products Inc.
 - 5. Michigan Hanger Co.
 - 6. Superior Valve Co.
 - 7. Tolco.
 - 8. Substitutions: Section 016000 - Product Requirements.
- B. Plumbing Piping - DWV:
 - 1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69, or MSS SP89.
 - 2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
 - 3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
 - 4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - 5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
 - 6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
 - 7. Vertical Support: Steel riser clamp.

8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 9. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.
- C. Plumbing Piping - Water:
1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69 or MSS SP89.
 2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
 3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
 4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
 5. Hangers for Hot Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll, double hanger.
 6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.
 8. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
 9. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
 10. Wall Support for Hot Pipe Sizes 6 inches and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
 11. Vertical Support: Steel riser clamp.
 12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 13. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 14. Floor Support for Hot Pipe Sizes 6 inches and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
 15. Copper Pipe Support: Copper-plated, Carbon-steel ring.

2.2 PLUMBING PIPING GAS

- A. Conform to NFPA 54, ASME 31.9, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89.
- B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
- C. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
- D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- E. Wall Support for Pipe 3 inches and Smaller: Cast iron hook.

- F. Vertical Support: Steel riser clamp.
- G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- H. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.3 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.4 MANUFACTURERS – SEISMIC BRACING

- A. Systems: Products of B-Line, Inc., Oakland, CA, are the standard of quality required and specified herein. Similar products of other manufacturers meeting the same standards of performance and approved by OSHPD or ORS/DSA may be submitted for approval.

2.5 INSERTS

- A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.6 FLASHING

- A. Metal Flashing: 24 gage thick galvanized steel.
- B. Metal Counterflashing: 24 gage thick galvanized steel.
- C. Lead Flashing:
 - 1. Waterproofing: 5 lb./sq. ft sheet lead.
 - 2. Soundproofing: 1 lb./sq. ft sheet lead.
- D. Flexible Flashing: 1/16 inch thick sheet; compatible with roofing.
- E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.7 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- C. Sealant: Acrylic.

2.8 FIRESTOPPING

- A. Manufacturers:
1. Dow Corning Corp.
 2. Fire Trak Corp.
 3. Hilti Corp.
 4. International Protective Coating Corp.
 5. 3M fire Protection Products.
 6. Specified Technology, Inc.
 7. Substitutions: Division 01 – General Requirements - Product Requirements.
- B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
1. Silicone Firestopping Elastomeric Firestopping: Single component silicone elastomeric compound and compatible silicone sealant.
 2. Foam Firestopping Compounds: Single component foam compound.
 3. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
 4. Fiber Stuffing and Sealant Firestopping: Composite of mineral fiber stuffing insulation with silicone elastomer for smoke stopping.
 5. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
 6. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
 7. Firestop Pillows: Formed mineral fiber pillows.
- C. Color: As selected from manufacturer's full range of colors.

2.9 FIRESTOPPING ACCESSORIES

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
- B. Dam Material: Permanent:
1. Mineral fiberboard.
 2. Mineral fiber matting.
 3. Sheet metal.
 4. Plywood or particle board.
 5. Alumina silicate fire board.
- C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- D. General:
1. Furnish UL listed products.

2. Select products with rating not less than rating of wall or floor being penetrated.
- E. Non-Rated Surfaces:
 1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.
 2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.
- C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
- B. Remove incompatible materials affecting bond.
- C. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- D. Do not drill or cut structural members.

3.3 INSTALLATION - INSERTS

- A. Install inserts for placement in concrete forms.
- B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install in accordance with ASME B31.1, ASME 31.9, ASTM F708, MSS SP 58, MSS SP 69 or MSS SP 89.
- B. Support horizontal piping as scheduled.
- C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.
- D. Place hangers within 12 inches of each horizontal elbow.
- E. Use hangers with 1-1/2 inch minimum vertical adjustment.
- F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.
- G. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- H. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- I. Support riser piping independently of connected horizontal piping.
- J. Provide copper plated hangers and supports for copper piping.
- K. Design hangers for pipe movement without disengagement of supported pipe.
- L. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- M. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 220700.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum 4 inches thick and extending 6 inches beyond supported equipment. Refer to Division 03.
- B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

- C. Construct supports of steel members or formed steel channel. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed. Refer to Section 210548.

3.6 INSTALLATION - FLASHING

- A. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.
- C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.
- D. Seal floor, shower and mop sink drains watertight to adjacent materials.
- E. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.7 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with mechanical sleeve seals.
- B. Set sleeves in position in forms. Provide reinforcing around sleeves.
- C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- D. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.
- E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with firestopping insulation and caulk. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- F. Install chrome plated steel escutcheons at finished surfaces.

3.8 INSTALLATION - FIRESTOPPING

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping and other items, requiring firestopping.

- B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.
- C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating, to uniform density and texture.
- D. Fire Rated Surface:
 - 1. Seal opening at floor, wall, partition, ceiling and roof as follows:
 - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
 - b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
 - c. Pack void with backing material.
 - d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
- E. Non-Rated Surfaces:
 - 1. Seal opening through non-fire rated wall, partition, floor, ceiling and roof opening as follows:
 - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
 - b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
 - c. Install type of firestopping material recommended by manufacturer.
 - 2. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.

3.9 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.10 CLEANING

- A. Division 01 – General Requirements: Requirements for cleaning.
- B. Clean adjacent surfaces of firestopping materials.

3.11 PROTECTION OF FINISHED WORK

- A. Division 01 – General Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

3.12 SCHEDULES

PIPE HANGER SPACING		
PIPE MATERIAL	MAXIMUM HANGER SPACING Feet	HANGER ROD DIAMETER Inches
Cast Iron (All Sizes)	5	5/8
Cast Iron (All Sizes) with 10 foot length of pipe	10	5/8
Copper Tube, 1-1/4 inches and smaller	6	1/2
Copper Tube, 1-1/2 inches and larger	10	1/2
Steel, 3 inches and smaller	12	1/2
Steel, 4 inches and larger	12	5/8

END OF SECTION 220529

NOT FOR BID

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Nameplates.
 - 2. Tags.
 - 3. Pipe markers.
 - 4. Ceiling tacks.
 - 5. Labels.
 - 6. Lockout devices.
- B. Related Sections:
 - 1. Division 09 - Finishes: Execution requirements for painting specified by this section.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Product Data: Submit manufacturers catalog literature for each product required.
- C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 QUALITY ASSURANCE

- A. Conform to NFPA 99 requirements for labeling and identification of medical gas piping systems and accessories.
- B. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.
- C. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 01 – General Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 EXTRA MATERIALS

- A. Division 01 – General Requirements: Spare parts and maintenance products.
- B. Furnish two containers of spray-on adhesive.

PART 2 - PRODUCTS

2.1 NAMEPLATES

- A. Manufacturers:
 - 1. Craftmark Identification Systems.
 - 2. Safety Sign Co.
 - 3. Seton Identification Products.
 - 4. Brady Co.
 - 5. Substitutions: Division 01 – General Requirements - Product Requirements.
- B. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

- A. Metal Tags:
 - 1. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges, supply with brass jack chain.
- B. Information Tags:
 - 1. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.
- C. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.3 PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- D. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.4 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color-coded head.
- B. Color code as follows:
 - 1. Plumbing valves: Green.

2.5 LABELS

- A. Description: Aluminum, size 1.9 x 0.75 inches, adhesive backed with printed identification.

2.6 LOCKOUT DEVICES

- A. Lockout Hasps:
 - 1. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.
- B. Valve Lockout Devices:
 - 1. Nylon device preventing access to valve operator, accepting lock shackle.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- A. Install identifying devices after completion of coverings and painting.
- B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- D. Install tags using corrosion resistant chain. Number tags consecutively by location.
- E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.
- F. Identify water heaters with plastic nameplates.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify valves in main and branch piping with tags.
- I. Identify piping, concealed or exposed, with plastic pipe markers, plastic tape pipe markers or stenciled painting. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
- J. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 220553

SECTION 220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plumbing piping insulation, jackets and accessories.
 - 2. Plumbing equipment insulation, jackets and accessories.
- B. Related Sections:
 - 1. Division 07 – Thermal and Moisture Protection: Product requirements for firestopping for placement by this section.
 - 2. Division 09 - Finishes: Execution requirements for painting insulation jackets and covering specified by this section.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C450 - Standard Practice for Prefabrication and Field Fabrication of Thermal Insulating Fitting Covers for NPS Piping, Vessel Lagging, and Dished Head Segments.
 - 2. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
 - 3. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
 - 4. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
 - 5. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. National Fire Protection Association:
 - 1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- C. Underwriters Laboratories Inc.:
 - 1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.

- C. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.
- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
- D. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience.

1.6 PRE-INSTALLATION MEETINGS

- A. Division 01 – General Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 – General Requirements: Environmental conditions affecting products on site.

- B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- C. Maintain temperature before, during, and after installation for minimum period of 24 hours.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Division 01 – General Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for man made fiber.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
 - 1. CertainTeed.
 - 2. Knauf.
 - 3. Johns Manville.
 - 4. Owens-Corning.
 - 5. Substitutions: Division 01 – General Requirements - Product Requirements.
- B. Manufacturers for Closed Cell Elastomeric Insulation Products:
 - 1. Aeroflex. Aerocell.
 - 2. Armacell, LLC. Armaflex.
 - 3. Nomaco. K-flex.
 - 4. Substitutions: Division 01 – General Requirements - Product Requirements.

2.2 PIPE INSULATION

- A. TYPE P-1: ASTM C547, molded glass fiber pipe insulation.
 - 1. Thermal Conductivity: 0.23 at 75 degrees F.
 - 2. Operating Temperature Range: 0 to 850 degrees F.
 - 3. Vapor Barrier Jacket: ASTM C1136, Type I, factory applied reinforced foil kraft with self-sealing adhesive joints.
 - 4. Jacket Temperature Limit: minus 20 to 150 degrees F.
- B. TYPE P-5: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.

1. Thermal Conductivity: 0.27 at 75 degrees F.
2. Operating Temperature Range: Range: Minus 70 to 180 degrees F.

2.3 PIPE INSULATION ACCESSORIES

- A. Vapor Retarder Lap Adhesive: Compatible with insulation.
- B. Covering Adhesive Mastic: Compatible with insulation.
- C. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.
- D. Piping 2 inches diameter and larger: Wood insulation saddle, hard maple. Inserts length: not less than 6 inches long, matching thickness and contour of adjoining insulation.
- E. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with stainless steel jacket single piece construction with self adhesive closure. Thickness to match pipe insulation.
- F. Adhesives: Compatible with insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Coordination and project conditions.
- B. Verify piping has been tested before applying insulation materials.
- C. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

- A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
- B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 078400 for penetrations of assemblies with fire resistance rating greater than one hour.
- C. Piping Systems Conveying Fluids Below Ambient Temperature:

1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
 2. Furnish factory-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips.
 3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe.
- D. Hot Piping Systems less than 140 degrees F:
1. Furnish factory-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.
 3. Do not insulate unions and flanges at equipment, but bevel and seal ends of insulation at such locations.
- E. Inserts and Shields:
1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
 2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
 - a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
 - b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
- F. Insulation Terminating Points:
1. Coil Branch Piping 1 inch and Smaller: Terminate hot water piping at union upstream of the coil control valve.
 2. Condensate Piping: Insulate entire piping system and components to prevent condensation.
- G. Closed Cell Elastomeric Insulation:
1. Push insulation on to piping.
 2. Miter joints at elbows.
 3. Seal seams and butt joints with manufacturer's recommended adhesive.
 4. When application requires multiple layers, apply with joints staggered.
 5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.
- H. High Temperature Pipe Insulation:
1. Install in multiple layers to meet thickness scheduled.
 2. Attach each layer with bands. Secure first layer with bands before installing next layer.
 3. Stagger joints between layers.
 4. Cover with seams located on bottom side of horizontal piping.

- I. Buried Piping: Insulate only where insulation manufacturer recommends insulation product may be installed in trench, tunnel or direct buried. Install factory fabricated assembly with inner all-purpose service jacket with self-sealing lap.
- J. Prepare pipe insulation for finish painting. Refer to Division 09.

3.3 SCHEDULES

- A. Water Supply Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches
Condensate Drains	P-1	1-1/4 inches and smaller 1-1/2 inches and larger	0.5 1.0
Domestic Hot Water Supply and Recirculation systems with domestic water temperature maintenance cable	P-1	1 inch and smaller 1-1/4 inches to 2 inches 2-1/2 inches and larger	1.0 1.5 2.0

END OF SECTION 220700

SECTION 221301 - SANITARY AND STORM SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Roof drains.
 - 2. Floor drains.
 - 3. Floor sinks.
 - 4. Cleanouts.
- B. Related Sections:
 - 1. Division 07 – Thermal and Moisture Protection: Product requirements for firestopping for placement by this section.
 - 2. Division 08 - Openings: Product requirements for access doors for placement by this section.
 - 3. Division 09 - Finishes: Product and execution requirements for painting specified by this section.
 - 4. Section 220503 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.
 - 5. Section 220523 - General-Duty Valves for Plumbing Piping: Product requirements for valves for placement by this section.
 - 6. Section 220529 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports [and firestopping] for placement by this section.
 - 7. Section 220553 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification for placement by this section.
 - 8. Section 220700 - Plumbing Insulation: Product and execution requirements for pipe insulation.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME A112.21.1 - Floor Drains.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Product Data:
 - 1. Sanitary Drainage Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.
- C. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of equipment and clean-outs.
- C. Operation and Maintenance Data: Submit frequency of treatment required for interceptors. Include, spare parts lists, exploded assembly views for pumps and equipment.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with the authority having jurisdiction's standards.
- B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with sewage ejector service facilities within 100 miles of Project.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 01 – General Requirements: Pre-installation meeting.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Product storage and handling requirements.
- B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 – General Requirements: Product Requirements.
- B. Do not install underground piping when bedding is wet or frozen.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.11 WARRANTY

- A. Division 01 – General Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for equipment.

1.12 EXTRA MATERIALS

- A. Division 01 – General Requirements: Spare parts and maintenance products.
- B. Furnish two sets of pump seals.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS – ROOF/FLOOR/DRAINS AND FLOOR SINKS

- A. J.R. Smith
- B. Zurn
- C. Josam

2.2 ACCEPTABLE MANUFACTURERS - CLEANOUTS

- A. J.R. Smith
- B. Zurn
- C. Josam

2.3 FLOOR DRAINS

- A. Floor Drain (FD-1): ASME A112.21.1; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

2.4 FLOOR SINKS

- A. Floor Sink: Lacquered Galvanized cast iron body with dome strainer. Refer to plumbing fixture schedule for more information.

2.5 ROOF DRAINS

- A. RD-1: ANSI A112.21.2; lacquered cast iron body with sump, removable cast iron dome strainer, membrane flange and membrane clamp with integral gravel stop

with adjustable underdeck clamp roof sump receiver waterproofing flange leveling frame adjustable extension sleeve (for insulation) or perforated or slotted ballast guard extension for inverted roof; see Schedule on drawings for Model number.

- B. OD-1: Lacquered cast iron body and clamp collar and bottom clamp ring; cast iron dome; pipe extended to 2 inches above flood elevation; see Schedule on drawings for Model number.

2.6 CLEANOUTS

- A. Exterior Surfaced Areas C.O.Y.B.: Round cast nickel bronze access frame and non-skid cover; see Schedule on drawings for Model number.
- B. Exterior Unsurfaced Areas G.C.O.: Line type with lacquered cast iron body and round epoxy coated gasketted cover; see Schedule on drawings for Model number.
- C. Interior Finished Floor Areas F.C.O.: Lacquered cast iron, two piece body with double drainage flange, weep holes, reversible clamping collar and adjustable nickel-bronze strainer, round with scoriated cover in service areas and round with depressed cover to accept floor finish in finished floor areas; see Schedule on drawings for Model number.
- D. Interior Finished Wall Areas W.C.O.: Line type with lacquered cast iron body and round epoxy coated gasketted cover and round stainless steel access cover secured with machine screw; see Schedule on drawings for Model number.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Coordination and project conditions.
- B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

- A. Remove scale and dirt, on inside and outside, before assembly.
- B. Prepare piping connections to equipment with flanges or unions.

END OF SECTION 221301

SECTION 223400 - FUEL-FIRED DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Commercial gas-fired water heaters.
 - 2. Expansion tank.
 - 3. Aquastats.
 - 4. Timer switch.
 - 5. Circulation pumps.
- B. Related Sections:
 - 1. Division 03 – Concrete: requirements for concrete housekeeping pads specified by this section.
 - 2. Section 220700 - Plumbing Insulation: Field applied insulation for domestic water heaters.
 - 3. Section 231123 - Facility Natural-Gas Piping: Execution requirements for gas piping connections specified by this section.
 - 4. Section 260503 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI Z21.10.1 - Gas Water Heaters Vol. I Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less.
 - 2. ANSI Z21.10.3 - Gas Water Heaters - Vol. III Storage, with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous Water Heaters.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. American Society of Mechanical Engineers:
 - 1. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
- D. National Fire Protection Association:
 - 1. NFPA 54 - National Fuel Gas Code.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.

- B. Shop Drawings: Indicate heater dimensions, size of taps, and performance data. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, taps, and drains.
- C. Product Data:
 - 1. Water Heaters: Submit dimensioned drawings of water heaters indicating components and connections to other equipment and piping. Indicate capacity and power requirements. Submit electrical characteristics and connection locations.
- D. Manufacturer's Installation Instructions: Submit mounting and support requirements.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit replacement part numbers and availability.

1.5 QUALITY ASSURANCE

- A. Conform to ASME Section VIII for construction of water heaters. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.
- B. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1 when tested in accordance with ANSI Z21.10.1 or ANSI Z21.10.3.
- C. Maintain one copy of document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 01 – General Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Products storage and handling requirements.
- B. Accept water heaters on site in original labeled cartons. Inspect for damage.
- C. Protect tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Division 01 – General Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for domestic water heaters packaged water heating systems.

1.11 EXTRA MATERIALS

- A. Division 01 – General Requirements: Spare parts and maintenance products.
- B. Furnish two pump seals.

PART 2 - PRODUCTS

2.1 COMMERCIAL GAS FIRED WATER HEATERS

- A. Manufacturers:
 - 1. A.O. Smith.
 - 2. Lochinvar.
 - 3. Bradford White.
 - 4. Substitutions: Division 01 – General Requirements: Product Requirements.
- B. Type: Automatic, natural gas-fired, vertical storage. Refer to plumbing equipment schedule for model information.
- C. Approval: By AGA as automatic storage water heater.

2.2 DOMESTIC WATER EXPANSION TANK

- A. Precharged welded steel tank with air charging valve and removable heavy duty butyl/ EPDM diaphragm or bladder separating water and air with a working pressure of 150 psig. All internal parts shall comply with FDA regulations and approvals. The tank shall have NPT stainless steel connection, gauge glass openings and drain and be constructed in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code. For model number see schedule on the drawings.

2.3 AQUASTATS

- A. Provide immersed type adjustable volatile liquid mercury tube switch similar to Mercoid Type DA-37-2 Range 5 (1 pole single), similar to Mercoid Type DA-37-127 Range 5 (2 pole duplex). Set in oversized tee and nipple in hot water return line for automatically controlling hot water circulators and hot water circulating pumps.

2.4 TIME SWITCH

- A. Provide an adjustable heavy duty self-starting synchronous motor clock (120 volt) in NEMA-1 enclosure for automatically controlling hot water circulators, hot water circulating pumps, distilled water booster pumps and demineralizer water booster pumps.
- B. Clock shall have seven-day calendar dial, similar to Tork Series W and the number of poles as required.

2.5 ACCEPTABLE MANUFACTURERS - IN-LINE CIRCULATION PUMPS

- A. Bell and Gossett, see schedules.

2.6 IN-LINE CIRCULATION PUMPS

- A. All bronze construction body, stainless steel face plate, 30% glass filled Noryl impeller, carbon steel shaft, stainless steel shaft sleeve, mechanical, carbon on silicon carbide seal, sealed precision steel ball bearing permanently lubricated motor bearings, maximum operating pressure of 150 psi; 1/12 HP, 115 volts, 2650 rpm, non-overloading type motor, drip-proof. For model number see schedule on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Maintain manufacturer's recommended clearances around and over water heaters.
- B. Install water heater on concrete housekeeping pad, minimum 32 inches high and 6 inches larger than water heater base on each side. Refer to Section 033000.
- C. Connect natural gas piping in accordance with NFPA 54.
- D. Connect domestic hot water and domestic cold water piping to supply and return water heater connections.
- E. Install the following piping accessories. Refer to Section 221100.
 - 1. On supply:
 - a. Thermometer well and thermometer.
 - 2. On return:
 - a. Thermometer well and thermometer.
 - b. Shutoff valve.
- F. Install the following piping accessories on natural gas piping connections. Refer to Section 231123.
- G. Install discharge piping from relief valves and drain valves to nearest floor sink.
- H. Install circulator and diaphragm expansion tank on water heater as indicated on the drawings.
- I. Install water heater trim and accessories furnished loose for field mounting.
- J. Install electrical devices furnished loose for field mounting.
- K. Install control wiring between water heater control panel and field mounted control devices.
- L. Connect flue to water heater outlet, full size of outlet.

END OF SECTION 223400

NOT FOR BID

SECTION 224000 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Water closets.
 - 2. Lavatories.
 - 3. Sinks.
 - 4. Insulation kit.
 - 5. Showers.
 - 6. Drinking fountains.
 - 7. Mop sinks.
 - 8. Water hammer arrestors.
 - 9. Trap primers.
 - 10. Hose bibbs.
 - 11. Access panels.
 - 12. Laundry box.
 - 13. Ice maker outlet box.
- B. Related Sections:
 - 1. Division 07 – Thermal and Moisture Protection: Product requirements for caulking between fixtures and building components for placement by this section.
 - 2. Section 260503 - Equipment Wiring Connections: Execution requirements for electric connections to sensor valves and faucets specified by this section.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
- B. American Society of Mechanical Engineers:
 - 1. ASME A112.6.1 - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
 - 2. ASME A112.18.1 - Plumbing Fixture Fittings.
 - 3. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures.
 - 4. ASME A112.19.2M - Vitreous China Plumbing Fixtures.
 - 5. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).
 - 6. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
 - 7. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.

- B. Product Data: Submit catalog illustrations of fixtures, sizes, utility sizes, trim, and finishes.
- C. Manufacturer's Installation Instructions: Submit installation methods and procedures.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists.

1.5 QUALITY ASSURANCE

- A. Provide products requiring electrical connections listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and indicated.
- B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 01 – General Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Product storage and handling requirements.
- B. Accept fixtures on site in factory packaging. Inspect for damage.
- C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.9 WARRANTY

- A. Division 01 – General Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for plumbing fixtures.

1.10 EXTRA MATERIALS

- A. Division 01 – General Requirements: Spare parts and maintenance products.
- B. Furnish two sets of faucet washers, flush valve service kits, and lavatory supply fittings.

PART 2 - PRODUCTS

2.1 FIXTURE REQUIREMENTS

- A. Accessible plumbing fixtures shall comply with all of the requirements in CBC Division 6.
- B. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
- C. Fixture controls shall comply with CBC Sections 11B-601.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for children's water closets, 11B-605.4 for urinals, 11B-606.4 for lavatories and sinks, 11B-607.5 for bathtubs, 11B-608.5 for showers, and 11B-611.3 for washing machines and clothes dryers.
- D. Accessible sinks shall be 6-1/2" deep maximum. Sinks shall be mounted with the front of the higher of the rim and counter surface 34" maximum above the finish floor or ground.
- E. Water supply and drain pipes under lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under lavatories and sinks. CBC Section 11B-606.

2.2 ACCEPTABLE MANUFACTURERS – FIXTURES

- A. American Standard
- B. Kohler
- C. Eljer

2.3 ACCEPTABLE MANUFACTURERS - FLUSH VALVES

- A. Sloan

2.4 ACCEPTABLE MANUFACTURERS - WATER CLOSET SEATS

- A. Olsonite
- B. Beneke
- C. Church

2.5 ACCEPTABLE MANUFACTURERS - FIXTURE CARRIERS

- A. J.R. Smith
- B. Zurn
- C. Josam

2.6 ACCEPTABLE MANUFACTURERS - FIXTURE TRIM

- A. Chicago Faucet

2.7 ACCEPTABLE MANUFACTURERS - MIXING VALVES (PRESSURE BALANCED)

- A. Symmons
- B. Leonard
- C. Powers

2.8 ACCEPTABLE MANUFACTURERS - SHOWERS

- A. American Standard
- B. Symmons
- C. Kohler

2.9 ACCEPTABLE MANUFACTURERS – DRINKING FOUNTAINS

- A. Elkay
- B. Haws
- C. Sunroc

2.10 ACCEPTABLE MANUFACTURERS - WATER HAMMER ARRESTORS

- A. J.R. Smith
- B. Zurn

C. Josam

2.11 ACCEPTABLE MANUFACTURERS - TRAP PRIMERS

A. J.R. Smith

B. Zurn

C. Josam

2.12 ACCEPTABLE MANUFACTURERS - HOSE BIBBS

A. Acorn

B. Woodford

C. Josam

2.13 WATER CLOSET, FLOOR MOUNTED, ACCESSIBLE

A. Bowl: ANSI A112.19.2M; 1.1 gallon per flush, siphon jet, vitreous china closet bowl with elongated rim, 17" high for accessibility, 1-1/2" top spud and china bolt caps. For model number see schedule on drawings.

B. Flush Valve: ANSI A112.18.1; exposed chrome plated, diaphragm type manual flush, escutcheon, vacuum breaker. For model number see schedule on drawings.

C. Seat: Solid elongated plastic, open front with self-sustaining hinge, brass bolts. For model number see schedule on drawings.

2.14 LAVATORY, WALL HUNG, ACCESSIBLE

A. Basin: ANSI A112.19.2; vitreous china lavatory with 4 inch high back, drillings on 4 inch centers, and rectangular basin with splash lip, front overflow. For model number see schedule on drawings.

B. Trim: ANSI A112.18.1; chrome plated combination supply fitting with strainer, water economy aerator, chrome plated 17 gage L.A. pattern cast brass P-trap and arm with secured escutcheon and flexible supplies. For model number see schedule on drawings.

C. Wall Mounted Carrier: ANSI A112.6.1; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs. For model number see schedule on drawings.

2.15 LAVATORY, COUNTER TOP, ACCESSIBLE

- A. Basin: ANSI A112.19.2; vitreous china unglazed rim for under counter mount, oval basin with front overflow. For model number see schedule on drawings.
- B. Trim: ANSI A112.18.1; chrome plated combination supply fitting with strainer, water economy aerator, chrome plated 17 gage L.A. pattern cast brass P-trap and arm with secured escutcheon and flexible supplies. For model number see schedule on drawings.

2.16 SINK, SINGLE COMPARTMENT, ACCESSIBLE

- A. Bowl: ANSI A112.19.3; 18 gage thick, Type 304 stainless steel, 6" depth self-rimming with undercoating, three hole punching, 3-1/2 inch strainer, ledgeback drilled for trim. For model number see schedule on drawings.
- B. Trim: ANSI A112.18.1; chrome plated gooseneck spout with lever handles, chrome plated 17 gage L.A. Pattern cast brass P-trap and arm with secured escutcheon, and rigid supplies. For model number see schedule on drawings.

2.17 SINK, DOUBLE COMPARTMENT

- A. Bowl: ANSI A112.19.3; 18 gage thick, Type 304 stainless steel, 8" depth self-rimming with undercoating, three hole punching, 3-1/2 inch strainer on right and strainer on left bowl, ledgeback drilled for trim, disposer under right bowl. For model number see schedule on drawings.
- B. Trim: ANSI A112.18.1; chrome plated gooseneck spout with single lever handles, chrome plated 17 gage L.A. Pattern cast brass P-trap and arm with escutcheon, rigid supplies. For model number see schedule on drawings.

2.18 INSULATION KIT

- A. Where lavatories or sinks are noted to be insulated for ADA accessible compliance, furnish the following: Safety covers conforming to ANSI A177.1, ASTM E84-07 and consisting of insulation kit of molded closet cell vinyl construction, 3/16 inch thick, white color, for insulating tailpiece, P-trap, valves and supply piping. Furnish with weep hole and angle valve access covers.

2.19 SHOWER, ACCESSIBLE

- A. Trim: ANSI A112.18.1; chrome plated supply with pressure balanced mixing valve bent shower arm with flow control and hand held shower with slide bar. For model number see schedule on drawings.

2.20 DRINKING FOUNTAIN AND BOTTLE FILLER, ACCESSIBLE

- A. Wall Mounted, Refrigerated fountain with E2H2O bottle filling station. 1.1 GPM with laminar flow, two level basins, 18 gauge, stainless steel, flexi guard bubbler,

vandal resistant front bottom, no touch sensor activated bottle filler. 115 V/60H2, 8GOH, 5.0. F.L. AMPS, 370 rated watts, lead free.

2.21 MOP SINK, FLOOR MOUNTED

- A. Bowl: Enameled cast iron, with 3" IPS drain and flat chrome strainer and vinyl rim guard. For model number see schedule on drawings.
- B. Trim: ANSI A112.18.1; chrome plated fitting with vacuum breaker, pail hook and hose thread outlet. For model number see schedule on drawings.

2.22 WATER HAMMER ARRESTORS

- A. ANSI A112.26.1; sized in accordance with manufacturer's recommendation, precharged suitable for operation in temperature range - 100 to 300 degrees F and maximum 250 psig working pressure; see Schedule on drawings for Model number.

2.23 TRAP PRIMERS

- A. TP-1; ANSI A112.26; cast bronze with 1/2-inch connection. See Schedule on drawings for Model number.
- B. TP-2: Provide a trap primer enclosed in a 12" x 12" x 4" NEMA-1 enclosure, with a 1/2" inch NPT female inlet complying with ANSI/ASME B1.20.1, outlet shall be 1/2" inch compression fitting, provide with circuit breaker, switch, timer, manual override, solenoid valve marked as UL Listed, electronic assembly tested and certified per UL #73, and backflow device anti-siphon atmospheric vacuum breaker IAPMO, ASSE 1001 and CSA. Provide in accordance with ASSE Standard No. 1018. See schedule on the drawings for model number.

2.24 HOSE BIBBS

- A. Provide recessed box, having one piece cast construction, stainless steel wall flange with a satin finish. The door shall be provided with a cam lock. Valves shall be cast bronze, exposed parts chrome-plated, tamper resistant lockshield bonnet and replaceable cartridge, 3/4 inch inlet for cold, and 3/4 inch outlet with vacuum breaker, See Schedules for Model No.

2.25 ACCESS PANELS

- A. 12" x 12" No. 4 finish stainless steel flush type, locate and set after review. Steel door and frame with metal flange with concealed hinges and screwdriver operated stainless steel cam lock. Karp style DSC-214M for fire rated construction use KRP-150FR with ring turn lock.

2.26 LAUNDRY HOSE BOX

- A. Recessed wall mounted corrosion resistant box complete with hot and cold supplies and 2" waste outlet. For model number see schedule on drawings.

2.27 ICE MAKER OUTLET BOX

- A. Recessed wall mounted corrosion resistant box complete with cold supply. For model number see schedule on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Coordination and project conditions.
- B. Verify walls and floor finishes are prepared and ready for installation of fixtures.
- C. Verify electric power is available and of correct characteristics.
- D. Confirm millwork is constructed with adequate provision for installation of counter top lavatories and sinks.

3.2 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
- C. Install components level and plumb.
- D. Install and secure fixtures in place with wall carriers and bolts.
- E. Seal fixtures to wall and floor surfaces with sealant as specified in Division 07 – Thermal and Moisture Protection, color to match fixture.
- F. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.4 INTERFACE WITH OTHER PRODUCTS

- A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.5 ADJUSTING

- A. Division 01 – General Requirements: Testing, adjusting, and balancing.
- B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

- A. Division 01 – General Requirements: Final cleaning.
- B. Clean plumbing fixtures and equipment.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Division 01 – General Requirements: Protecting installed construction.
- B. Do not permit use of fixtures before final acceptance.

END OF SECTION 224000

NOT FOR BID

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes single- and three-phase motors for application on equipment provided under other sections.
- B. Related Sections:
 - 1. Division 26 - Grounding and Bonding for Electrical Systems.
 - 2. Division 26 - Identification for Electrical Systems.

1.2 REFERENCES

- A. American Bearing Manufacturers Association:
 - 1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- B. National Electrical Manufacturers Association:
 - 1. NEMA MG 1 - Motors and Generators.
- C. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Product Data: Submit catalog data for each motor. Indicate nameplate data, standard compliance, electrical ratings and characteristics, and physical dimensions, weights, mechanical performance data, and support points.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Product storage and handling requirements.
- B. Protect products from weather and moisture by covering with plastic or canvas and by maintaining heating within enclosure.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS FOR MOTORS FURNISHED WITH EQUIPMENT

- A. Manufacturers: Shall be in accordance with equipment manufacturer's preference.

- B. Motors 1 hp and Larger: Three-phase motor as specified below.
- C. Motors Smaller than 1 hp: Single-phase motor as specified below, except motors less than 250 watts or 1/4 hp may be equipment manufacturer's standard.
- D. Three-Phase Motors: NEMA MG 1, Design B, energy-efficient squirrel-cage induction motor, with windings to accomplish starting methods and number of speeds.
 - 1. Voltage: As indicated on Drawings.
 - 2. Service Factor: 1.15.
 - 3. Enclosure: Meet conditions of installation unless specific enclosure is indicated on Drawings.
 - 4. Design for continuous operation in 40 degrees C environment, with temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
 - 5. Insulation System: NEMA Class F. Motor insulation shall meet UL flame/smoke rating of 25/50 or less.
 - 6. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
 - 7. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay with wiring to terminal box.
 - 8. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
 - 9. Sound Power Levels: Conform to NEMA MG 1.
- E. Single Phase Motors:
 - 1. Permanent split-capacitor type, where available, otherwise use split-phase start/capacitor run or capacitor start/capacitor run motor.
 - 2. HVAC motors for fans less than 1 hp and greater than 1/12 hp shall be ECM or have minimum motor efficiency of 70%. Motors must have means to adjust motor speed for balancing or remote control.
 - 3. Voltage: As indicated on drawings.
- F. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- B. Install engraved plastic nameplates in accordance with Division 26.

- C. Ground and bond motors in accordance with Division 26.

3.2 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.15.

END OF SECTION 230513

NOT FOR BID

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Pipe hangers and supports.
 2. Hanger rods.
 3. Flashing.
 4. Equipment curbs.
 5. Sleeves.
 6. Mechanical sleeve seals.
 7. Formed steel channel.
 8. Firestopping accessories.
 9. Equipment bases and supports.
 10. See Contract Drawings for seismic bracing of ductwork, piping and equipment.
- B. Related Sections:
1. Division 07 – Thermal and Moisture Protection: Product requirements for firestopping for placement by this section.
 2. Division 07 – Thermal and Moisture Protection: Product requirements for sealant materials for placement by this section.
 3. Division 09 - Finishes: Product and execution requirements for painting specified by this section.
 4. Section 230548 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product and execution requirements for vibration isolators.
 5. Section 232300 – Refrigerant Piping.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
1. ASME B31.5 - Refrigeration Piping.
 2. ASME B31.9 - Building Services Piping.
- B. ASTM International:
1. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
 2. ASTM E814 - Standard Test Method for Fire Tests of Through Penetration Fire Stops.
 3. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
 4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
- C. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

- D. FM Global:
 - 1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.
- E. Manufacturers Standardization Society of the Valve and Fittings Industry:
 - 1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
 - 2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
 - 3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- F. Underwriters Laboratories Inc.:
 - 1. UL 263 - Fire Tests of Building Construction and Materials.
 - 2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
 - 3. UL 1479 - Fire Tests of Through-Penetration Firestops.
 - 4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
 - 5. UL - Fire Resistance Directory.
- G. Intertek Testing Services (Warnock Hersey Listed):
 - 1. WH - Certification Listings.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.
- C. Product Data:
 - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
 - 2. Firestopping: Submit data on product characteristics, performance and limitation criteria.
- D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
- E. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers. Submit sizing methods or calculations sealed by a registered professional engineer.
- F. Manufacturer's Installation Instructions:
 - 1. Hangers and Supports: Submit special procedures and assembly of components.
 - 2. Firestopping: Submit preparation and installation instructions.

- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years experience.
- B. Installer: Company specializing in performing Work of this section with minimum five years documented experience.

1.5 PRE-INSTALLATION MEETINGS

- A. Division 01 – General Requirements: Pre-installation meeting.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.8 WARRANTY

- A. Division 01 – General Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for pipe hangers and supports.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. B-Line Systems.
 - 2. Anvil.
 - 3. Tolco.
- B. Refrigerant Piping:
 - 1. Conform to ASME B31.5.

2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron or Carbon steel, adjustable swivel, split ring.
3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
4. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
5. Vertical Support: Steel riser clamp.
6. Copper Pipe Support: Copper-plated carbon-steel ring.

2.2 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 FLASHING

- A. Metal Flashing: 24 gage thick galvanized steel.
- B. Metal Counterflashing: 22 gage thick galvanized steel.
- C. Lead Flashing:
 1. Waterproofing: 5 lb./sq. ft sheet lead.
 2. Soundproofing: 1 lb./sq. ft sheet lead.
- D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.
- E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.4 EQUIPMENT CURBS

- A. See drawings and equipment specification sections.

2.5 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- B. Sleeves for Round Ductwork: Galvanized steel.
- C. Sleeves for Rectangular Ductwork: Galvanized steel or wood.
- D. Sealant: Refer to Section 079000.

2.6 MECHANICAL SLEEVE SEALS

- A. Manufacturers:
 1. Thunderline Link-Seal, Inc.
 2. NMP Corporation.
 3. Substitutions: Division 01 – General Requirements - Product Requirements.

- B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FORMED STEEL CHANNEL

- A. Manufacturers:
1. Allied Tube & Conduit Corp.
 2. B-Line Systems.
 3. Midland Ross Corporation, Electrical Products Division.
 4. Unistrut Corp.
- B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.8 FIRESTOPPING

- A. Manufacturers:
1. Dow Corning Corp.
 2. Hilti Corp.
 3. 3M Fire Protection Products
 4. Fire Trak Corp.
 5. International Protective Coating Corp.
 6. Specified Technology, Inc.
 7. Substitutions: Division 01 – General Requirements - Product Requirements.
- B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
1. Silicone Firestopping Elastomeric Firestopping: Single or Multiple component silicone elastomeric compound and compatible silicone sealant.
 2. Formulated Firestopping Compound of Incombustible Fibers: Formulated compound mixed with incombustible non-asbestos fibers.
 3. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
 4. Mechanical Firestopping Device with Fillers: Mechanical device with incombustible fillers and silicone elastomer, covered with sheet stainless steel jacket, joined with collars, penetration sealed with flanged stops.
 5. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
 6. Firestop Pillows: Formed mineral fiber pillows.
 7. Firestopping material shall maintain an effective barrier against flame and gases in compliance with the following requirement.
 - a. Flame Spread: 25 or less, ASTM E84.
 - b. Smoke Development: 50 or less, ASTM E84.

- c. Combustibility: noncombustible, ASTM E136.
- 8. Material, when installed, shall have the same fire rating as the assembly in which it is being installed.

C. Color: Dark gray or black.

D. Also refer to Division 07 – Thermal and Moisture Protection.

2.9 FIRESTOPPING ACCESSORIES

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
- B. Dam Material: Permanent:
 - 1. Mineral fiberboard.
 - 2. Mineral fiber matting.
 - 3. Sheet metal.
 - 4. Alumina silicate fire board.
 - 5. Plywood or particle board.
- C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- D. General: Furnish UL listed products. Select products with rating not less than rating of wall or floor being penetrated.
- E. Non-Rated Surfaces:
 - 1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where piping is exposed.
 - 2. For exterior wall openings below grade, furnish mechanical sealing device to continuously fill annular space between piping and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install in accordance with ASME B31.5 and ASME 31.9.
- B. Support horizontal piping as scheduled.
- C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.
- D. Place hangers within 12 inches of each horizontal elbow.
- E. Use hangers with 1-1/2 inch minimum vertical adjustment.

- F. Support vertical piping at every floor.
- G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Provide packing between hanger or support and piping.
- J. Design hangers for pipe movement without disengagement of supported pipe.
- K. Prime coat exposed steel hangers and supports. Refer to Division 09. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- L. Provide clearance in hangers and from structure and other equipment for installation of insulation. Refer to Section 220700.

3.2 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- B. Construct supports of steel members, formed steel channel and steel pipe and fittings. Brace and fasten with flanges bolted to structure.
- C. Provide rigid anchors for pipes after vibration isolation components are installed. Refer to Section 210548.

3.3 INSTALLATION - FLASHING

- A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- B. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms for sound control.
- C. Provide curbs for roof installations 11 inches minimum high above roofing surface. Flash and counter-flash with sheet metal; seal watertight. Attach counterflashing to equipment and lap base flashing on roof curbs. Flatten and solder joints.
- D. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.4 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with mechanical sleeve seals.

- B. Set sleeves in position in forms. Provide reinforcing around sleeves.
- C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- D. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with stuffing, firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- E. Install chrome plated steel escutcheons at finished surfaces.

3.5 INSTALLATION - FIRESTOPPING

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, and other items, requiring firestopping.
- B. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating and as recommended by the manufacturer's instruction.
- C. Fire Rated Surface:
 - 1. Seal opening at floor, wall, partition, ceiling, and roof as follows:
 - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
 - b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
 - c. Pack void with backing material.
 - d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
 - 2. Where cable tray, bus, cable bus, conduit, wireway, trough, and penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.
- D. Non-Rated Surfaces:
 - 1. Seal opening through non-fire rated wall, partition, floor, ceiling, and roof opening as follows:
 - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
 - b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
 - c. Install type of firestopping material recommended by manufacturer.
 - 2. Install escutcheons, floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.
 - 3. Exterior wall openings below grade: Assemble rubber links of mechanical sealing device to size of piping and tighten in place, in accordance with manufacturer's instructions.

4. Interior partitions: Seal pipe penetrations at clean rooms, laboratories, hospital spaces, computer rooms, telecommunication rooms and data rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.6 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.7 CLEANING

- A. Division 01 – General Requirements: Requirements for cleaning.

3.8 PROTECTION OF FINISHED WORK

- A. Division 01 – General Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

3.9 SCHEDULES

- A. Maximum Copper and Steel Pipe Hanger Spacing:

PIPE SIZE Inches	COPPER TUBING MAXIMUM HANGER SPACING Feet	STEEL PIPE MAXIMUM HANGER SPACING Feet	COPPER TUBING HANGER ROD DIAMETER Inches	STEEL PIPE HANGER ROD DIAMETER Inches
1/2	5	7	3/8	3/8
3/4	5	7	3/8	3/8
1	6	7	3/8	3/8

3.10 SEISMIC BRACING

- A. Provide seismic bracing of pipe, ductwork and equipment for SMACNA Seismic Restraint Manual Guidelines in accordance with CBC, and ASCE requirements. See Contractor Drawings for additional details.

END OF SECTION 230529

NOT FOR BID

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Vibration isolators.
 - 2. Ductwork lagging.
- B. Related Sections:
 - 1. Division 07 – Thermal and Moisture Protection: Product requirements for joint sealers specified for placement by this section.
 - 2. Division 08 - Openings: Product requirements for acoustic wall louvers.
 - 3. Section 230529 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports.
 - 4. Section 230593 - Testing, Adjusting, and Balancing for HVAC: Requirements for sound and vibration measurements performed independent of this section.
 - 5. Section 233300 - Air Duct Accessories: Product requirements for both solid and flexible duct connectors for duct silencers specified for placement by this section.
 - 6. Section 235400 – Furnaces.

1.2 REFERENCES

- A. Air Movement and Control Association International, Inc.:
 - 1. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
- B. American National Standards Institute:
 - 1. ANSI S1.4 - Sound Level Meters.
 - 2. ANSI S1.8 - Reference Quantities for Acoustical Levels.
 - 3. ANSI S1.13 - Methods for the Measurement of Sound Pressure Levels in Air.
 - 4. ANSI S12.36 - Survey Methods for the Determination of Sound Power Levels of Noise Sources.
- C. Air-Conditioning and Refrigeration Institute:
 - 1. ARI 575 - Method of Measuring Machinery Sound within Equipment Space.
- D. American Society of Heating, Refrigerating and:
 - 1. ASHRAE 68 - Laboratory Method of Testing In-Duct Sound Power Measurement Procedure for Fans.
 - 2. ASHRAE Handbook - HVAC Applications.

- E. ASTM International:
 - 1. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
 - 2. ASTM E477 - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
 - 3. ASTM E596 - Standard Test Method for Laboratory Measurement of the Noise Reduction of Sound-Isolating Enclosures.
- F. Sheet Metal and Air Conditioning Contractors':
 - 1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide vibration isolation on motor driven equipment over 0.5 hp, plus connected piping and ductwork.
- B. Provide minimum static deflection of isolators for equipment as follows:
 - 1. Upper Floors, Normal
 - a. Under 400 rpm: Per manufacturer.
 - b. 400 - 600 rpm: 3.5 inch
 - c. 600 - 800 rpm: 2 inch
 - d. 800 - 900 rpm: 1 inch
 - e. 1100 - 1500 rpm: 0.5 inch
 - f. Over 1500 rpm: 0.2 inch
- C. Consider upper floor locations critical unless otherwise indicated.
- D. Maintain sound level of spaces at levels not to exceed those listed below by utilizing acoustical devices.
- E. Maintain rooms at following maximum sound levels, in Noise Criteria (NC), Room Criteria (RC) as defined by ASHRAE Handbook., HVAC Applications.
 - 1. Offices
 - a. Conference rooms: 30
 - b. Private: 35
 - c. Open Office: 35
 - 2. Sleeping Quarters
 - a. Private Rooms: 25
 - b. Corridors: 30
 - c. Public Areas
 - d. Kitchen/Dining/Living Room: 35 - 40
 - e. Lobby: 40
 - f. Family Visit Room: 40

1.4 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.

- B. Shop Drawings: Indicate and locate vibration isolators, with static and dynamic load on each. Indicate assembly, materials, thickness, dimensional data, pressure losses, acoustical performance, layout, and connection details for sound attenuation products fabricated for this project.
- C. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating, materials, dimensional data, pressure losses, and acoustical performance for standard sound attenuation products.
- D. Design Data: Submit calculations indicating maximum room sound levels are not exceeded.
- E. Manufacturer's Installation Instructions: Submit special procedures and setting dimensions. Indicate installation requirements maintaining integrity of sound isolation.
- F. Manufacturer's Certificate: Certify isolators meet or exceed specified requirements.
- G. Manufacturer's Field Reports: Indicate sound isolation installation is complete and in accordance with instructions.

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of cross-talk silencers, acoustic housings, ductwork lagging.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with AMCA 300, ANSI S1.13, ARI 575, ANSI S12.36, standards and recommendations of ASHRAE 68.
- B. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum five years documented experience.

1.8 PRE-INSTALLATION MEETINGS

- A. Division 01 – General Requirements: Pre-installation meeting.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Division 01 – General Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for inertia bases.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Manufacturers:
 - 1. Mason-Industries.
 - 2. MW Sausee.
 - 3. Approved equal.
 - 4. Substitutions: Section 016100 - Product Requirements.
- B. Open Spring Isolators:
 - 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 - 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - 3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
 - 4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
- C. Restrained Spring Isolators:
 - 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 - 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - 3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
 - 4. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
 - 5. Restraint: Furnish mounting frame and limit stops.

- D. Closed Spring Isolators:
1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
 3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance.
- E. Restrained Closed Spring Isolators:
1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
 3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch clearance and limit stops.
- F. Spring Hanger:
1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 3. Housings: Incorporate rubber hanger with threaded insert.
 4. Misalignment: Capable of 20 degree hanger rod misalignment.
- G. Neoprene Pad Isolators:
1. Rubber or neoprene-waffle pads.
 - a. 30 durometer.
 - b. Minimum 1/2 inch thick.
 - c. Maximum loading 40 psi.
 - d. Height of ribs: not to exceed 0.7 times width.
- H. Rubber Mount or Hanger: Molded rubber designed for 0.5 inches deflection with threaded insert.

- I. Glass Fiber Pads: Neoprene jacketed pre-compressed molded glass fiber.
- J. Seismic Snubbers:
 - 1. Type: Non-directional and double acting unit consisting of interlocking steel members restrained by neoprene elements.
 - 2. Neoprene Elements: Replaceable, minimum of 0.75 inch thick.
 - 3. Capacity: 4 times load assigned to mount groupings at 0.4 inch deflection.
 - 4. Attachment Points and Fasteners: Capable of withstanding 3 times rated load capacity of seismic snubber.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Coordination and project conditions.
- B. Verify equipment, ductwork and piping is installed before work in this section is started.

3.2 INSTALLATION

- A. Install isolation for motor driven equipment.
- B. Adjust equipment level.
- C. Install spring hangers without binding.
- D. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- E. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- F. Support piping connections to isolated equipment resiliently as follows:
 - 1. Up to 4 inch Diameter: First three points of support.
 - 2. 5 to 8 inch Diameter: First four points of support.
 - 3. 10 inch Diameter and Over: First six points of support.
 - 4. Select three hangers closest to vibration source for minimum 1.0 inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch static deflection or 1/2 static deflection of isolated equipment.

3.3 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Closeout Requirements.

- B. Inspect isolated equipment after installation and submit report. Include static deflections.
- C. Refer to Section 230593 for sound measurements.
- D. Furnish services of testing agency to take noise measurement. Use meters meeting requirements of ANSI S1.4.

3.4 SCHEDULES

- A. See Contract Drawings for requirements.

END OF SECTION 230548

NOT FOR BID

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Nameplates.
 - 2. Tags.
 - 3. Pipe markers.
 - 4. Ceiling tacks.
 - 5. Labels.
- B. Related Sections:
 - 1. Division 09 - Finishes: Execution requirements for painting specified by this section.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Product Data: Submit manufacturers catalog literature for each product required.
- C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Samples: Submit two tags, labels, pipe markers and size used on project.
- E. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.5 QUALITY ASSURANCE

- A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.
- B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum five years documented experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 01 – General Requirements: Pre-installation meeting.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 EXTRA MATERIALS

- A. Division 01 – General Requirements: Spare parts and maintenance products.

PART 2 - PRODUCTS

2.1 NAMEPLATES

- A. Manufacturers:
 - 1. Craftmark Identification Systems.
 - 2. Safety Sign Co.
 - 3. Seton Identification Products.
- B. Product Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

2.2 TAGS

- A. Plastic Tags:
 - 1. Manufacturers:
 - a. Craftmark Identification Systems.
 - b. Safety Sign Co.
 - c. Seton Identification Products.
 - 2. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches diameter.

- B. Metal Tags:
 - 1. Manufacturers:
 - a. Craftmark Identification Systems.
 - b. Safety Sign Co.
 - c. Seton Identification Products.
 - 2. Stainless Steel with stamped letters; tag size minimum 1-1/2 inches diameter or square with finished edges.
- C. Information Tags:
 - 1. Manufacturers:
 - a. Craftmark Identification Systems.
 - b. Safety Sign Co.
 - c. Seton Identification Products.
 - 2. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches with grommet and self-locking nylon ties.

2.3 PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1.
- B. Plastic Pipe Markers:
 - 1. Manufacturers:
 - a. Craftmark Identification Systems.
 - b. Safety Sign Co.
 - c. Seton Identification Products.
 - 2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
- C. Plastic Tape Pipe Markers:
 - 1. Manufacturers:
 - a. Craftmark Identification Systems.
 - b. Safety Sign Co.
 - c. Seton Identification Products.
 - 2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

2.4 CEILING TACKS

- A. Manufacturers:
 - 1. Craftmark Identification Systems.
 - 2. Safety Sign Co.
 - 3. Seton Identification Products.
- B. Description: Steel with 3/4 inch diameter color-coded head.
- C. Color code as follows:
 - 1. HVAC equipment: Yellow.
 - 2. Fire dampers/smoke dampers: Red.

3. Plumbing valves: Green.
4. Heating/cooling valves: Blue.

2.5 LABELS

- A. Manufacturers:
 1. Craftmark Identification Systems.
 2. Safety Sign Co.
 3. Seton Identification Products.
- B. Description: Laminated Mylar, size 1.9 x 0.75 inches, adhesive backed with printed identification and bar code.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Division 09 for stencil painting.

3.2 INSTALLATION

- A. Apply stencil painting in accordance with Division 09.
- B. Install identifying devices after completion of coverings and painting.
- C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- E. Install tags using corrosion resistant chain. Number tags consecutively by location.
- F. Identify air conditioning/heating units and exhaust fans with plastic nameplates.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify valves in main and branch piping with tags.
- I. Tag automatic controls, instruments, and relays. Key to control schematic.
- J. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification

not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

- K. For exposed natural gas lines other than steel pipe, attach yellow pipe labels with "GAS" in black lettering, at maximum 5 foot spacing.
- L. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.3 SCHEDULES

- A. Identification: Shall be per ANSI Standard.

END OF SECTION 230553

NOT FOR BID

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Testing adjusting and balancing of air systems.
 - 2. Measurement of final operating condition of HVAC systems.
 - 3. Sound measurement of equipment operating conditions.
 - 4. Vibration measurement of equipment operating conditions.
 - 5. Verification of fire/smoke damper operation.

1.2 REFERENCES

- A. Associated Air Balance Council:
 - 1. AABC MN-1 - National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.
- C. Natural Environmental Balancing Bureau:
 - 1. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Prior to commencing Work, submit proof of latest calibration date of each instrument.
- C. Test Reports: Indicate data on AABC MN-1 National Standards for Total System Balance forms or NEBB Report Forms.
- D. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- E. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing, and equipment data required. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty or copy of NEBB Certificate of Conformance Certification.
- F. Submit draft copies of report for review prior to final acceptance of Project.

- G. Furnish reports in soft cover, letter size, 3-ring binder manuals, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of flow measuring stations of balancing valves and rough setting.
- C. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AABC MN-1 National Standards for Field Measurement and Instrumentation, Total System Balance or NEBB Procedural Standard for Testing, Balancing and Adjusting of Environmental Systems.
- B. Maintain one copy of each document on site.
- C. Prior to commencing Work, calibrate each instrument to be used.

1.6 QUALIFICATIONS

- A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum years documented experience certified by AABC or certified by NEBB.
- B. Perform Work under supervision of AABC or NEBB Certified Test and Balance Engineer.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 01 – General Requirements: Pre-installation meeting.

1.8 SEQUENCING

- A. Section Division 01 – General Requirements: Work sequence.
- B. Sequence balancing between completion of systems tested and Date of Substantial Completion.

1.9 SCHEDULING

- A. Division 01 – General Requirements: Coordination and project conditions.

- B. Schedule and provide assistance in final adjustment and test of life safety system with Fire Authority.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Coordination and project conditions.
- B. Verify systems are complete and operable before commencing work. Verify the following:
 - 1. Systems are started and operating in safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Fire and volume dampers are in place and open.
 - 8. Air coil fins are cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.
 - 10. Air outlets are installed and connected.
 - 11. Duct system leakage is minimized.

3.2 PREPARATION

- A. Furnish instruments required for testing, adjusting, and balancing operations.
- B. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

3.3 INSTALLATION TOLERANCES

- A. Air Conditioning Systems: Adjust to within plus or minus 10 percent of design.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 10 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.4 ADJUSTING

- A. Division 01 – General Requirements: Testing, adjusting, and balancing.
- B. Verify recorded data represents actual measured or observed conditions.

- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.
- E. Report defects and deficiencies noted during performance of services, preventing system balance.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.
- H. Check and adjust systems approximately six months after final acceptance and submit report.

3.5 AIR SYSTEM PROCEDURE

- A. Adjust air conditioning and distribution systems to obtain required or design supply, return, and exhaust air quantities.
- B. Make air quantity measurements in main ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.
- E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.
- F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.
- L. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately 0.05 inches positive static pressure near building entries.

3.6 FIRE/SMOKE DAMPERS

- A. Provide field verification of fire/smoke damper per code requirement including, but not limited to, the following:
 - 1. Visual confirmation of the complete closure of the dampers when the fire/alarm system is in simulated fire modes and during power simulated power failure.
 - 2. Visual confirmation that the dampers are fully open during normal modes without any unusual noise and vibrations.

3.7 SCHEDULES

- A. Equipment Requiring Testing, Adjusting, and Balancing:
 - 1. Air Conditioning Units.
 - 2. Split System Air Conditioning Systems
 - 3. Fans.
 - 4. Air Filters.
 - 5. Air Inlets and Outlets.
- B. Report Forms
 - 1. Title Page:
 - a. Name of Testing, Adjusting, and Balancing Agency
 - b. Address of Testing, Adjusting, and Balancing Agency
 - c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency
 - d. Project name
 - e. Project location
 - f. Project Architect
 - g. Project Engineer
 - h. Project Contractor
 - i. Project altitude
 - j. Report date
 - 2. Summary Comments:
 - a. Design versus final performance
 - b. Notable characteristics of system
 - c. Description of systems operation sequence
 - d. Summary of outdoor and exhaust flows to indicate building pressurization

- e. Nomenclature used throughout report
- f. Test conditions
- 3. Instrument List:
 - a. Instrument
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Range
 - f. Calibration date
- 4. Electric Motors:
 - a. Manufacturer
 - b. Model/Frame
 - c. HP/BHP and kW
 - d. Phase, voltage, amperage; nameplate, actual, no load
 - e. RPM
 - f. Service factor
 - g. Starter size, rating, heater elements
 - h. Sheave Make/Size/Bore
- 5. V-Belt Drive:
 - a. Identification/location
 - b. Required driven RPM
 - c. Driven sheave, diameter and RPM
 - d. Belt, size and quantity
 - e. Motor sheave diameter and RPM
 - f. Center to center distance, maximum, minimum, and actual
- 6. Air Moving Equipment:
 - a. Location
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Arrangement/Class/Discharge
 - f. Air flow, specified and actual
 - g. Return air flow, specified and actual
 - h. Outside air flow, specified and actual
 - i. Total static pressure (total external), specified and actual
 - j. Inlet pressure
 - k. Discharge pressure
 - l. Sheave Make/Size/Bore
 - m. Number of Belts/Make/Size
 - n. Fan RPM
- 7. Return Air/Outside Air Data:
 - a. Identification/location
 - b. Design air flow
 - c. Actual air flow
 - d. Design return air flow
 - e. Actual return air flow
 - f. Design outside air flow
 - g. Actual outside air flow
 - h. Return air temperature

- i. Outside air temperature
- j. Required mixed air temperature
- k. Actual mixed air temperature
- l. Design outside/return air ratio
- m. Actual outside/return air ratio
- 8. Exhaust Fan Data:
 - a. Location
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Air flow, specified and actual
 - f. Total static pressure (total external), specified and actual
 - g. Inlet pressure
 - h. Discharge pressure
 - i. Sheave Make/Size/Bore
 - j. Number of Belts/Make/Size
 - k. Fan RPM
- 9. Duct Traverse:
 - a. System zone/branch
 - b. Duct size
 - c. Area
 - d. Design velocity
 - e. Design air flow
 - f. Test velocity
 - g. Test air flow
 - h. Duct static pressure
 - i. Air temperature
 - j. Air correction factor
- 10. Duct Leak Test:
 - a. Description of ductwork under test
 - b. Duct design operating pressure
 - c. Duct design test static pressure
 - d. Duct capacity, air flow
 - e. Maximum allowable leakage duct capacity times leak factor
 - f. Test apparatus
 - 1) Blower
 - 2) Orifice, tube size
 - 3) Orifice size
 - 4) Calibrated
 - g. Test static pressure
 - h. Test orifice differential pressure
 - i. Leakage
- 11. Air Distribution Test Sheet:
 - a. Air terminal number
 - b. Room number/location
 - c. Terminal type
 - d. Terminal size
 - e. Area factor
 - f. Design velocity

TR DESIGN GROUP
CONSTRUCTION DOCS

COUNTY OF SAN BERNARDINO
DEPARTMENT OF BEHAVIORAL HEALTH
CRISIS RESIDENTIAL TREATMENT FACILITY
SUNHILL DR. & HESPERIA RD., CA 92395
MAY 27, 2016

- g. Design air flow
- h. Test (final) velocity
- i. Test (final) air flow
- j. Percent of design air flow

END OF SECTION 230593

NOT FOR BID

SECTION 230700 - HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. HVAC piping insulation, jackets and accessories.
 - 2. HVAC ductwork insulation, jackets, and accessories.
- B. Related Sections:
 - 1. Division 07 – Thermal and Moisture Protection: Product requirements for firestopping for placement by this section.
 - 2. Division 09 - Finishes: Execution requirements for painting insulation jackets and covering specified by this section.
 - 3. Section 232300 – Refrigerant Piping.
 - 4. Section 233100 – HVAC Ducts and Casings.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
 - 2. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - 3. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
 - 4. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
 - 5. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
 - 6. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
 - 7. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - 8. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
 - 9. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
 - 10. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
 - 11. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - 12. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
 - 13. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
 - 14. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

15. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
 16. ASTM D1785 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 17. ASTM D4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
 18. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
 19. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
- B. Sheet Metal and Air Conditioning Contractors':
1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- C. Underwriters Laboratories Inc.:
1. UL 1978 - Standard for Safety for Grease Ducts.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- C. Samples: Submit two samples of representative size illustrating each insulation type.
- D. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

- A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding 5 in accordance with ASTM E84.
- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
- D. Duct insulation, Coverings, and Linings: Maximum 25/50 flame spread/smoke developed index, when tested in accordance with ASTM E84, using specimen procedures and mounting procedures of ASTM E 2231.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Applicator: Company specializing in performing Work of this section with minimum five years documented experience.

1.6 PRE-INSTALLATION MEETINGS

- A. Division 01 – General Requirements: Pre-installation meeting.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 016100 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 – General Requirements: Environmental conditions affecting products on site.
- B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Division 01 – General Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
 - 1. CertainTeed.
 - 2. Knauf.
 - 3. Johns Manville.
 - 4. Owens-Corning.

- B. Manufacturers for Closed Cell Elastomeric Insulation Products:
1. Aeroflex. Aerocell.
 2. Armacell, LLC. Armaflex.
 3. Nomaco. K-flex.

2.2 PIPE INSULATION

- A. TYPE P-5: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
1. Thermal Conductivity: 0.27 at 75 degrees F.
 2. Operating Temperature Range: Range: Minus 70 to 180 degrees F.

2.3 PIPE INSULATION JACKETS

- A. Aluminum Pipe Jacket:
1. ASTM B209.
 2. Thickness: 0.025 inch thick sheet.
 3. Finish: Smooth.
 4. Joining: Longitudinal slip joints and 2 inch laps with caulking.
 5. Fittings: 0.025 inch thick die shaped fitting covers with factory attached protective liner.
 6. Metal Jacket Bands: 1/2 inch wide; 0.010 inch thick stainless steel.

2.4 PIPE INSULATION ACCESSORIES

- A. Covering Adhesive Mastic: Compatible with insulation.
- B. Piping 1-1/2 inches diameter and smaller: Galvanized steel insulation protection shield. MSS SP-69, Type 40. Length: Based on pipe size and insulation thickness.
- C. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with stainless steel jacket single piece construction with self-adhesive closure. Thickness to match pipe insulation.
- D. Adhesives: Compatible with insulation.

2.5 DUCTWORK INSULATION

- A. TYPE D-1: ASTM C1290, Type III, flexible glass fiber, commercial grade with factory applied reinforced aluminum foil jacket meeting ASTM C1136, Type II.
1. Thermal Conductivity: 0.25 at 75 degrees F.
 2. Maximum Operating Temperature: 250 degrees F.
 3. Density: 1.5 pound per cubic foot.
- B. TYPE D-4: ASTM C1071, Type I, flexible, glass fiber duct liner with coated air side.
1. Thermal Conductivity: 0.24 at 75 degrees F.
 2. Density: 1.5 pound per cubic foot.

3. Maximum Operating Temperature: 250 degrees F.
4. Maximum Air Velocity: 6,000 feet per minute.

2.6 DUCTWORK INSULATION JACKETS

- A. Exterior Ductwork: Provide dual wall ductwork with specified insulation per Section 23 321 00.
- B. Vapor Retarder Jacket:
 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 2. Water Vapor Permeance: ASTM E96/E96M; 0.02 perms.
 3. Secure with pressure sensitive tape.
- C. Canvas Duct Jacket: UL listed, 6 oz/sq yd, plain weave cotton fabric with fire retardant lagging adhesive compatible with insulation.

2.7 DUCTWORK INSULATION ACCESSORIES

- A. Vapor Retarder Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- B. Vapor Retarder Lap Adhesive: Compatible with insulation.
- C. Adhesive: Waterproof, ASTM E162 fire-retardant type.
- D. Liner Fasteners: Galvanized steel, welded with press-on head.
- E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- F. Lagging Adhesive: Fire retardant type with maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- G. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad.
- H. Adhesives: Compatible with insulation.
- I. Membrane Adhesives: As recommended by membrane manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Coordination and project conditions.
- B. Verify piping, equipment and ductwork has been pressure tested before applying insulation materials.
- C. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

- A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
- B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 078400 for penetrations of assemblies with fire resistance rating greater than one hour.
- C. Inserts and Shields:
 - 1. Piping 1-1/2 inches Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
 - 2. Piping 2 inches Diameter and Larger: Install insert between support shield and piping and under finish jacket.
 - a. Insert Configuration: Minimum 6 inches long, of thickness and contour matching adjoining insulation; may be factory fabricated.
 - b. Insert Material: Compression resistant insulating material suitable for planned temperature range and service.
- D. Insulation Terminating Points:
 - 1. Condensate Piping: Insulate entire piping system and components to prevent condensation.
- E. Closed Cell Elastomeric Insulation:
 - 1. Push insulation on to piping.
 - 2. Miter joints at elbows.
 - 3. Seal seams and butt joints with manufacturer's recommended adhesive.
 - 4. When application requires multiple layers, apply with joints staggered.
 - 5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.
- F. Piping Exterior to Building: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal piping.
- G. Prepare pipe insulation for finish painting. Refer to Section 099000.

3.3 INSTALLATION - DUCTWORK SYSTEMS

- A. Duct dimensions indicated on Drawings are finished inside dimensions.
- B. Insulated ductwork conveying air below ambient temperature:
 - 1. Provide insulation with vapor retarder jackets.
 - 2. Finish with tape and vapor retarder jacket.

3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- C. Insulated ductwork conveying air above ambient temperature:
1. Provide with or without standard vapor retarder jacket.
 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- D. Ductwork Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket sized for finish painting.
- E. External Glass Fiber Duct Insulation:
1. Secure insulation with vapor retarder with wires and seal jacket joints with vapor retarder adhesive or tape to match jacket.
 2. Secure insulation without vapor retarder with staples, tape, or wires.
 3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
 4. Seal vapor retarder penetrations by mechanical fasteners with vapor retarder adhesive.
 5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
- F. Duct and Plenum Liner:
1. Adhere insulation with adhesive for 100 percent coverage.
 2. Secure insulation with mechanical liner fasteners. Comply with SMACNA Standards for spacing.
 3. Seal and smooth joints. Seal and coat transverse joints.
 4. Seal liner surface penetrations with adhesive.
 5. Cut insulation for tight overlapped corner joints. Support top pieces of liner at edges with side pieces.
 6. Line 15 feet upstream and downstream of air handler fan.
- G. Prepare duct insulation for finish painting. Refer to Section 099000.

3.4 SCHEDULES

A. Cooling Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches
Refrigerant Suction	P-5	All sizes	.5

B. Ductwork Insulation Schedule:

DUCTWORK SYSTEM	INSULATION TYPE	INSULATION THICKNESS inches
Supply Ducts (internally insulated) Minimum R8 Valve	D-4	2.0
Return Ducts (internally insulated) Minimum R8 Valve	D-4	2.0
Supply Ducts (externally insulated) Minimum R8 Valve	D-1	3.0
Return Ducts (externally insulated) Minimum R8 Valve	D-1	3.0
Transfer Air Ducts (internally insulated)	D-4	1.0

END OF SECTION 230700

SECTION 230900 – BUILDING AUTOMATION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes control equipment and installation for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-furnished controls.
- B. See "Sequences of Operation" for requirements that relate to this Section.

1.2 RELATED DOCUMENTS

- A. Drawings and Specification Sections of the Contract, including General and Supplementary Conditions, apply to this Section.
 - 1. Division 01 – General Requirements.
 - 2. Section 233103 – Detection and Alarm (Fire and Smoke Alarm Systems)
 - 3. Section 230500 – Common Work Results for HVAC
 - 4. Section 230 93 – Testing, Adjusting, and Balancing for HVAC
 - 5. Section 235400 – Furnaces
 - 6. Section 238126 – Split System Air Conditioner
 - 7. Section 260000 – General Electrical Provisions for Electrical Work
 - 8. Section 260500 – Common Work Results for Electrical
 - 9. Section 260519 – Low Voltage Electrical Power Conductors and Cables
 - 10. Section 260529 – Hangers and Supports for Electrical Systems
 - 11. Section 260533 – Raceway and Boxes for Electrical Systems
 - 12. Section 260553 – Identification for Electrical Systems
 - 13. Section 262726 – Wiring Devices

1.3 DEFINITIONS

- A. BACnet: An industry standard data communication protocol for Building Automation and Control Networks. Refer to AHSRAE standard 135-2010
- B. BIBB: BACnet Interoperability Building Blocks
- C. DDC: Direct digital controls
- D. IP: Internet Protocol
- E. I/O: Input/Output
- F. LAN: Local area network.
- G. MS/TP: Master-slave/token-passing. Refer to AHSRAE standard 135-2010

- H. TCP: Transfer Control Protocol
 - 1. Scope Terminology
 - 2. Provide = Furnish equipment, engineer, program and install
 - 3. Furnish = Furnish equipment, engineer and program
 - 4. Mount = securely fasten or pipe
 - 5. Install = mount and wire
 - 6. Wire = wire only

1.4 SYSTEM DESCRIPTION

- A. The Building Automation System (BAS) contractor shall furnish and install a networked system of HVAC controls. The contractor shall incorporate direct digital control (DDC) for central plant equipment, building ventilation equipment, supplemental heating and cooling equipment, and terminal units.
- B. Provide networking to new DDC equipment using communication standards. System shall be capable of BACnet communication according to ASHRAE standard ANSI/ASHRAE 135-2010 for interoperability with smart equipment and for the main IP communication trunk to the BAS Server. The system shall not be limited to only standard protocols, but shall also be able to integrate to a wide variety of third-party devices and applications via drivers and gateways.
- C. Provide standalone controls where called for on the drawings or sequences.

1.5 WORK INCLUDED

- A. The installation of the control system shall be performed under the direct supervision of the controls manufacturer with the shop drawings, flow diagrams, bill of materials, component designation, or identification number and sequence of operation all bearing the name of the manufacturer.
- B. Furnish a complete distributed direct digital control system in accordance with this specification section. This includes all system controllers, logic controllers, and all input/output devices. Items of work included are as follows:
 - 1. Provide a submittal that meets the requirements below for approval.
 - 2. Coordinate installation schedule with the mechanical contractor and general contractor.
 - 3. Provide installation of all panels and devices unless otherwise stated.
 - 4. Provide power for panels and control devices.
 - 5. Provide all low voltage control wiring and conduit for the DDC system.
 - 6. Provide miscellaneous control wiring and conduit for HVAC and related systems regardless of voltage.
 - 7. Provide engineering and technician labor to program and commission software for each system and operator interface. Submit commissioning reports for approval.
 - 8. Provide testing, demonstration and training as specified below.

1.6 SYSTEM PERFORMANCE

- A. Comply with the following performance requirements:
1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 5 seconds.
 2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 5 seconds.
 3. Object Command: Reaction time of less than 5 seconds between operator command of a binary object and device reaction.
 4. Object Scan: Transmit change of state and change of analog values to control units or workstation within 5 seconds.
 5. Alarm Response Time: Annunciate alarm at workstation within 2 seconds. Multiple workstations must receive alarms within five seconds of each other.
 6. Program Execution Frequency: Programmable controllers shall execute DDC PI control loops, and scan and update process values and outputs at least once per second.
 7. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
 - a. Water Temperature: Plus or minus 1 deg F.
 - b. Water Flow: Plus or minus 5 percent of full scale.
 - c. Water Pressure: Plus or minus 2 percent of full scale.
 - d. Space Temperature: Plus or minus 1 deg F.
 - e. Ducted Air Temperature: Plus or minus 1 deg F.
 - f. Outside Air Temperature: Plus or minus 2 deg F.
 - g. Dew Point Temperature: Plus or minus 3 deg F.
 - h. Temperature Differential: Plus or minus 0.25 deg F.
 - i. Relative Humidity: Plus or minus 2 percent.
 - j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
 - k. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
 - l. Airflow (Terminal): Plus or minus 10 percent of full scale.
 - m. Air Pressure (Space): Plus or minus 0.01-inch wg.
 - n. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
 - o. Carbon Monoxide: Plus or minus 5 percent of reading.
 - p. Carbon Dioxide: Plus or minus 50 ppm.
 - q. Electrical: Plus or minus 5 percent of reading.

1.7 SUBMITTALS

- A. Provide submittals for fast track items that need to be approved and released to meet the schedule of the project. Provide submissions for the following items separately:
1. Valve schedule and cut sheets
 2. Factory mounting and wiring diagrams and cut sheets
 3. Thermostat locations
- B. Provide BIM symbols (Revit) for control devices that are to be shown on the coordinated BIM model.

- C. Provide a complete submittal with all controls system information for approval before construction starts. Include the following:
1. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
 2. Wiring Diagrams: Power, signal, and control wiring.
 3. Details of control panel faces, including sizes, controls, instruments, and labeling.
 4. Schedule of dampers and actuators including size, leakage, and flow characteristics.
 5. If dampers are furnished by other, submit a damper actuator schedule coordinating actuator sizes with the damper schedule.
 6. Schedule of valves including leakage and flow characteristics.
 7. Written description of the Sequence of Operations.
 8. Network riser diagram showing wiring types, network protocols, locations of floor penetrations and number of control panels. Label control panels with network addresses and BACnet device instance numbers. Show all routers, switches, hubs and repeaters.
 9. Point list for each system controller including both inputs and outputs (I/O), point numbers, controlled device associated with each I/O point, and location of I/O device.
 10. Starter and variable frequency drive wiring details of all automatically controlled motors.
 11. Reduced size floor plan drawings showing locations of control panels, thermostats and any devices mounted in occupied space.
- D. Wireless Communication: If wireless sensors and / or network are used, submit a radio signal layout showing the signal reach of every wireless mesh device. Show where repeaters are needed so that a wireless signals overlap
- E. Product Data: Include manufacturer's technical literature for each control device indicated, labeled with setting or adjustable range of control. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated. Submit a write-up of the application software that will be used on the operator workstation including revision level, functionality and software applications required to meet the specifications.
- F. Submit PICS statements for all direct digital controllers and interfaces.
- G. Submit a description of the application software that will be used on the operator workstation including revision level, functionality and software applications required to meet the specifications.
- H. Wiring Diagrams: Detail the wiring of the control devices and the panels. Show point-to-point wiring from field devices to the control panel. Show point-to-point wiring of hardwired interlocks. Show a ladder diagram or schematic of wiring internal to the panels, including numbered terminals. Clearly designate wiring that is done at a factory, at a panel shop or in the field.

- I. Submit blank field check-out and commissioning test reports, customized for each panel or system, which will be filled out by the technician during start-up.
- J. Submit sample graphics for approval before starting system commissioning.
- K. Variance letter: Submit a letter detailing each item in the submission that varies from the contract specification or sequence of operation in any way.
- L. After the BAS system is approved for construction, submit sample operator workstation graphics for typical systems for approval. Print and submit the graphics that the operator will use to view the systems, change setpoints, modify parameters and issue manual commands. Programming shall not commence until typical graphics are approved.

1.8 QUALITY ASSURANCE

A. Codes

- 1. Perform all wiring in accordance with Division 26, NEC, local codes and Owner's requirements.
- 2. Uniform Building Code (UBC)
- 3. 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.
- 4. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."
- 5. Comply with ASHRAE 135-2010 BACNet: A Data Communication Protocol for Building Automation and Control Networks.
- 6. All equipment shall be UL listed and approved and shall meet with all applicable NFPA standards, including UL 916 - PAZX Energy Management Systems,
- 7. Provide UL 864 – UUKL Smoke Control, where controllers and networks are used for that purpose.
- 8. Provide written approvals and certifications after installation has been completed. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.
- 9. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing) and ISO-140001 (The application of well-accepted business management principles to the environment). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.

B. Qualifications

- 1. Installing contractor shall be in the business of installing and servicing DDC controls for mechanical systems, temperature and ventilation control, environmental control, lighting control, access and security controls,

and energy automation as their primary business. Installer Qualifications: An experienced installer who is the authorized representative of the automatic control system manufacturer for both installation and maintenance of controls required for this Project.

2. Engineering, drafting, programming, and graphics generation shall be performed by the local branch engineers and technicians directly employed by the Building Automation System Contractor.
3. Supervision, checkout and commissioning of the system shall be by the local branch engineers and technicians directly employed by the Building Automation System Contractor. They shall perform commissioning and complete testing of the BAS system.

- C. The BMS contractor shall maintain a service organization consisting of factory trained service personnel and provide a list of ten (10) projects, similar in size and scope to this project, completed within the last five years.
- D. Final determination of compliance with these specifications shall rest solely with the Engineers and Owner who will require proof of prior satisfactory performance.
- E. For any BAS system and equipment submitted for approval, the BAS contractor shall state what, if any, specific points of system operation differ from these specifications.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. **Factory-Mounted Components:** Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to unit manufacturer.

1.10 COORDINATION

- A. Coordinate location of thermostats, panels, and other exposed control components with plans and room details before installation.
- B. Coordinate equipment with Section 283100 "Fire Alarm" to achieve compatibility with equipment that interfaces with that system.
- C. Coordinate power for control units and operator workstation with electrical contractor.
- D. Coordinate equipment with provider of starters and drives to achieve compatibility with motor starter control coils and VFD control wiring.
- E. Coordinate scheduling with the mechanical contractor and general contractor. Submit a schedule for approval based upon the installation schedule of the mechanical equipment.
- F. Products Furnished but Not Installed Under This Section
 1. Refrigerant Piping

- a. Pressure and Temperature Sensor Wells and Sockets
- 2. Sheetmetal accessories
 - a. Dampers
- G. Products Integrated To but Not Furnished or Installed Under This Section
 - 1. Split DX coil/furnace systems
 - 2. Ductless split cooling only systems
 - 3. Lighting Control panels
 - 4. Fire Alarm monitoring

1.11 WARRANTY

- A. Conform to the warranty requirement of the Contract Documents, General Requirements and this section or a minimum of 12 months. Provide the strictest.
- B. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of one year from completion of system demonstration.
- C. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours.
- D. During normal building occupied hours, failure of items that are critical for system operation shall be provided within 4 hours of notification from the Owner's Representative.
- E. This warranty shall apply equally to both hardware and software.

PART 2 - PRODUCTS

2.1 ACCEPTABLE SYSTEMS

- A. Provide a Building Automation System based upon the following:
 - 1. Siemens APOGEE System as installed by the Siemens Industry branch office. Following the County of San Bernardino standards.
- B. The vendors and products listed shall comply with these specifications. It shall not be assumed that standard products and methods will be acceptable without prior approval. Exceptions shall be noted during the bid process and documented in the submittal process.

2.2 BAS NETWORK

- A. All networked control products provided for this project shall be comprised of an industry standard open protocol internetwork. Communication involving control components (i.e. all types of controllers and operator interfaces) shall conform to

ASHRAE 135-2010 BACnet standard. Networks and protocols proprietary to one company or distributed by one company are prohibited.

- B. Access to system data shall not be restricted by the hardware configuration of the building management system. The hardware configuration of the BMS network shall be totally transparent to the user when accessing data or developing control programs.
 - 1. Software applications, features, and functionality, including administrative configurations, shall not be separated into several network control engines working together.
- C. Provide at a minimum 1 operator interface to be designated as the BAS Server with server application software. Additional operator interfaces shall use operator workstation licenses or connect via a thick or thin-client application.
- D. BAS Server shall be capable of simultaneous direct connection and communication with BACnet/IP, OPC and TCP/IP corporate level networks without the use of interposing devices.
- E. Any break in Ethernet communication from the PC to the controllers on the Primary Network shall result in a notification at the PC.
- F. Any break in Ethernet communication between the standard client and server workstations on the Primary Network shall result in a notification at each workstation.
- G. The network architecture shall consist of three levels of networks:
 - 1. The Management level shall utilize BACnet/IP over Ethernet along with other standardized protocol, such as web services, html, JAVA, SOAP, XML, etc., to transmit data to non-BAS softwares and databases.
 - 2. The Automation level network shall be BACnet/IP over Ethernet. It shall network the Automation Server, Operator workstations, and BC level controllers. Provide network media converters, routers and switches as necessary for a complete network.
 - 3. The Floor level network shall be BACnet over MS/TP. It shall network to all of the DDC controlled equipment on a floor or in a system and network to a router that connects to the Automaton level BAS backbone. Controllers for the central plant and large infrastructure air handlers shall reside on the backbone BACnet/IP network.
- H. The primary backbone network between the building level controllers, BAS Server and Operator Workstations shall be based upon BACnet/IP. Ethernet Network switches shall be strategically placed through the building to cover several floors or several mechanical rooms that are within 300 ft wiring-feet of each other.
- I. The Building Level Controllers shall be able to support subnetwork protocols that may be needed depending on the type of equipment or application. Subnetworks shall be limited to :
 - 1. BACnet MS/TP

- J. BACnet MSTP Setup rules
 - 1. Addressing for the MSTP devices shall start at 00 and continue sequentially for the number of devices on the subnetwork.
 - 2. No gaps shall be allowed in the addresses.
 - 3. Set the MaxMaster property to the highest address of the connected device.
 - 4. MaxMaster property shall be adjusted when devices are added to the subnetwork.
- K. Application specific controllers for smaller single zone, supplemental or special systems can reside on the BACnet/IP network or on a subnetwork.
- L. Floor level controllers, split AC units, auxiliary equipment, meters shall reside on one of the subnetworks above.
- M. Provide all communication media, connectors, repeaters, bridges, switches, and routers necessary for the internetwork.
- N. Use fiber optic cabling for all Ethernet runs longer than 300 ft.
- O. Controllers and software shall be BTL listed at the time of installation.
- P. Provide all communication media, connectors, repeaters, bridges, switches, and routers necessary for the internetwork.
- Q. The system shall meet peer-to-peer communication services such that the values in any one BC or AAC level controller can be read or changed from all other controllers with the need for intermediary devices. The software shall provide transparent transfer of all data, control programs, schedules, trends, and alarms from any one controller through the internetwork to any other controller, regardless of subnetwork routers.
- R. Systems that use variations of BACnet using Point-to-Point (PTP) between controllers, gateways, bridges or networks that are not peer-to-peer are not allowed.
- S. Remote Communications: Provide a TCP/IP compatible communication port for connection to the Owner's network for remote communications. Provide coordination with the Owner for addressing and router configuration on both ends of the remote network.
- T. Where a smoke control application is required, provide UUKL listed network switches, and NFPA approved cabling, enclosures and installation methods.
- U. The system shall be installed with a 10% spare capacity on each subnetwork for the addition of future controllers.

2.3 DISTRIBUTED CONTROL REQUIREMENTS

- A. The loss of any one DDC controller shall not affect the operation of other HVAC systems, only for the points connected to the DDC controller.
- B. The system shall be scalable in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, DDC Controllers, and operator devices.
- C. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each DDC Controller shall operate independently by performing its own specified control, alarm management, operator I/O, and data collection. The failure of any single component or network connection shall not interrupt the execution of any control strategy, reporting, alarming and trending function, or any function at any operator interface device.
- D. DDC Controllers shall be able to access any data from, or send control commands and alarm reports directly to, any other DDC Controller on the network without dependence upon a central processing device. DDC Controllers shall also be able to send alarms to multiple operator workstations without dependence upon a central or intermediate processing device.
- E. The DDC control panel shall be mounted in the same mechanical room as the equipment being controlled, or an adjacent utility room.
- F. Multiple systems can be programmed on the same controller as long as they are in the same room. Systems on separate floors shall have separate controllers.
- G. Remote sensors shall be wired to the control panel of the equipment it is controlling, not across the network.
- H. Signals to remote motor control centers shall be hard wired to the control panel, not across the network.

2.4 BUILDING AUTOMATION SERVER HARDWARE

- A. Provide a PC for the BAS Server database. Provide the latest model of the nominal speed, RAM and memory for a commercial office grade PC from a named brand manufacturer. Minimum requirements and accessories shall be:
 - 1. Processor: Intel 7 series or AMD equal
 - 2. 3GHz processor speed minimum 6M cache
 - 3. 20GB Ram, Dual Channel, DDR3 SDRam at 1333MHz minimum
 - 4. 16x R/W CD and DVD
 - 5. 320GB Hard disk space, 7200RPM
 - 6. Video Card with 512 MB RAM
 - 7. USB Ports
 - 8. NIC Card
 - 9. 101 key enhanced keyboard, Mouse, power strip
 - 10. UPS for 15 minute backup

- B. Provide a wide screen, active matrix LCD, flat panel type monitor that supports a minimum display resolution of no less than 1920 × 1080 pixels, Energy Star compliant 32-bit color. The display shall have a minimum of 21-inch visible area in diagonal measurement. Separate controls shall be provided for color, contrasts and brightness. The screen shall be non-reflective.
- C. Printer: Provide a compatible inkjet or laser printer for alarms, operator transactions and system reports. Provide drivers.
- D. Printer2: Provide a color printer for printing of dynamic trend graph report, Excel reports, graphics and any other screen displays. Printer shall include as a minimum Okidata Microline 590 or equivalent.
- E. Locate the BAS Server in a clean, secure, dry and temperature controlled environment
- F. The server shall reside on the same BACnet/IP protocol network as the System Controllers.
- G. Provide software licenses for interfacing to the BAS. Load software, configure and setup for viewing the BAS system.
- H. Provide with the PC an operating system, such as Windows 7 64-bit or Windows 2008 R2.
- I. Software: Provide the following application software licenses, preloaded on the laptop for the Owner: MS Office Professional, PC anywhere or terminal services, Internet Explorer or equal browser, MS Outlook, Acrobat Reader, CAD Viewer, Micrographx Designer. Set up an icon on the desktop to take the Owner directly to the BAS system login page.

2.5 OPERATOR WORKSTATIONS HARDWARE

- A. The Server hardware shall be of equal or better capability as that of Workstation and shall be equipped as follows.
- B. Locate server as located on plans.
- C. Provide a minimum 16 GB RAM, with hard drive of 320 GB available space, with a video card with 256 MB RAM capable of supporting a minimum of 1920 x 1080 resolution with a minimum of 32 Bit color, DVD-RW Drive, mouse and 101-key enhanced keyboard. Server shall be a Windows 2008 R2 Server, and shall include a dual core processor or better.
- D. Provide a monitor of flat panel type and shall support a minimum display resolution of no less than 1920 x 1080 pixels. The display shall have a minimum of 21-inch visible area in diagonal measurement. Separate controls shall be provided for color, contrasts and brightness. The screen shall be non-reflective.

- E. Locate the Operator Workstations in a clean, secure, dry and temperature controlled environment
- F. Provide software licenses for interfacing to the BAS. Load software, configure and setup for viewing the BAS system.
- G. Provide the PC with an operating system, such as Windows XP/Vista or Windows Server 2003/2008 or other operating systems compatible with the BAS software.
- H. Software: Provide the following application software licenses, preloaded on the laptop for the Owner: MS Office Professional, PC anywhere or terminal services, Internet Explorer or equal browser, MS Outlook, Acrobat Reader, CAD Viewer. Set up an icon on the desktop to take the Owner directly to the BAS system login page.

2.6 OPERATOR SERVER SOFTWARE

- A. Server-Client connections
 - 1. The Web based interface shall provide the same functionalities as those available at any other workstation, including operation and configuration capabilities.
 - 2. The Web server client licensing shall be from the same pool of client licenses available or installed client consoles or Windows desktop app clients.
 - 3. Internet connections, ISP services, as well as necessary firewalls or proxy servers shall be provided by the owner as required to support the Web access feature.
- B. Client access to client-server workstation configurations over the Intranet or Internet shall be available via 3 client options:
 - 1. Web Browser. Client runs in a browser as a Full Trust client application.
 - 2. Dedicated Installed Application. Client runs as a fully installed software installation that can lockdown desktop space and prevent the ability for the software to be minimized or covered by other applications.
 - 3. Windows Desktop App. An app that is downloaded to the client from the server PC, that runs like an installed application, and is automatically updated whenever new apps are available at the server.
- C. Graphics creation – user shall be able to add/delete/modify system graphics from standard user interface without the need of any external or specialized tools.

2.7 SERVER HOSTED WEB BASED OPERATOR SOFTWARE

- A. The BMS shall provide a Web-based graphical interface that allows users to access the BMS data via the Internet, extranet, or Intranet. Functionality of web-based clients shall provide the same functionality and user interface provided by installed client consoles.

- B. A Web server computer will be supplied. The Web server shall use Microsoft's IIS server with Windows 2008 R2 Server, or later, and support browser access via Microsoft Internet Explorer.
- C. All information exchanged over Internet shall be optionally encrypted and secure via SSL (provided by Owner).
- D. Web interfaces shall require the use of certificates to ensure safe secure connectivity to the server.
- E. Access to the Web interface may be password protected. Users' rights and privileges to points and graphics may be the same as those assigned at any other workstation, or may be differentiated from privileges at installed workstations.
- F. The Web interface shall not require modification or creation of HTML or ASP pages using an HTML editor. All graphics shall be available with the same look and functionality whether they are displayed at an installed client console or in a browser.
- G. The Web based interface shall provide the same functionalities as those available at any other workstation, including operation and configuration capabilities.
- H. The Web server client licensing shall be from the same pool of client licenses available or installed client consoles or Windows desktop app clients.
- I. Internet connections, ISP services, as well as necessary firewalls or proxy servers shall be provided by the owner as required to support the Web access feature.

2.8 OPERATOR INTERFACE APPLICATION SOFTWARE

- A. Graphical User Interface (GUI): The GUI shall provide a completely interactive user interface and must offer the following features as a minimum:
 - 1. View Trending
 - 2. View Scheduling
 - 3. Downloading Memory to field devices
 - 4. Real time 'live' Graphic Programs with auto refresh
 - 5. System Name and Geographic Navigation methods
 - 6. Parameter changes of all adjustable object properties
 - 7. Setpoint Adjustments
 - 8. Viewing Alarms and Events
 - 9. Operators' Usage
 - 10. Hyperlinks
 - 11. On line help menus
- B. BACNET:
 - 1. The BAS server and Operator Workstations shall meet the BACnet device profile of an Advanced Workstation Server (B-AWS) and Operator Workstation (B-OWS) and shall support the following BACnet BIBBs:

- a. Data Sharing
 - 1) Data Sharing-Read Property-Initiate, Execute (DS-RP-A,B)
 - 2) Data Sharing-Read Property Multiple-Initiate, Execute (DS-RPM-A,B)
 - 3) Data Sharing-Write Property-Initiate, Execute (DS-WP-A,B)
 - 4) Data Sharing-Write Property Multiple-Initiate (DS-WPM-A)
 - 5) Data Sharing-COV-Initiate (DS-COV-A)
 - b. Scheduling
 - 1) Scheduling-Initiate (SCHED-A)
 - c. Trending
 - 1) Trending-Viewing and Modifying Trends-Initiate (T-VMT-A)
 - 2) Trending-Automated Trend Retrieval-Initiate (T-ATR-A)
 - d. Network Management
 - 1) Network Management-Connection Establishment-Initiate (NM-CE-A)
 - e. Alarming
 - 1) Alarm and Event-Notification-Initiate (AE-N-A)
 - 2) Alarm and Event-ACK-Initiate (AE-ACK-A)
 - 3) Alarm and Event –Alarm Summary-Initiate (AE-ASUM-A)
 - 4) Alarm and Event –Enrollment Summary-Initiate (AE-ESUM-A)
 - 5) Alarm and Event –Information-Initiate (AE-INFO-A)
 - f. Device Management
 - 1) Device Management-Dynamic Device Binding- Initiate, Execute (DM-DDB-A, B)
 - 2) Device Management-Dynamic Object Binding- Initiate, Execute (DM-DOB-A,B)
 - 3) Device Management-Device Communication Control- Initiate (DM-DCC-A)
 - 4) Device Management-Private Transfer- Initiate, Execute (DM-PT-A,B)
 - 5) Device Management-Text Message-Execute (DM-TM-B)
 - 6) Device Management-Time Synchronization- Initiate (DM-TS-A)
 - 7) Device Management-UTC Time Synchronization- Initiate (DM-UTC-A)
 - 8) Device Management-Reinitialize Device- Initiate (DM-RD-A)
 - 9) Device Management-Backup and Restore- Initiate (DM-BR-A)
 - 10) Device Management-List Manipulation- Initiate, Execute (DM-LM-A,B)
 - 11) Device Management-Object Creation and Deletion- Initiate (DM-OCD-A)
2. The BAS Server and Workstations shall support the following Data Link Layers:
- a. BACnet IP Annex J

- b. BACnet IP Annex J Foreign Device
 - c. ISO 8802-3, Ethernet (Clause 7)
 - 3. The BAS Server and Workstations shall be able to interact with all of the BACnet objects in the controllers. In addition, the software shall be able to support the following objects as they relate to features in the workstation software:
 - a. Calendar – Creatable, Deletable
 - b. Command – Creatable, Deletable
 - c. Event Enrollment – Creatable, Deletable
 - d. Notification Class – Creatable, Deletable
 - e. Schedule - Creatable, Deletable
 - 4. The BAS Server and Workstations shall support transmitting and receiving segmented messages.
 - 5. The BAS Server and Workstation shall have the capability to be the BACnet/IP Broadcast Management Device (BBMD) and support foreign devices.
- C. System shall be capable of OPC client communicating according to OPC Data Access 2.0
- D. Provide a copy of the software (or all software's if there are multiple) used to program and download sequences to controllers. Provide a backup of the all of the programs used in the system for storage by the Owner.

2.9 BASIC INTERFACE DESCRIPTION

- A. All operator interface functions must be available in clients running in a browser, installed client console, or Windows desktop app.
- B. Operator interface software shall minimize operator training through the use of user-friendly and interactive graphical applications, 256-character English language point identification, on-line help, and industry standard Windows application software. Interface software shall simultaneously communicate with and share data between Ethernet-connected building level networks.
- C. The user interface shall display relevant information for a selection in multiple panes of a single window without the need for opening multiple overlapping windows on the desktop
- D. Provide a graphical user interface that shall minimize the use of keyboard through the use of a mouse or similar pointing device, with a "point and click" approach to menu selection and a "drag and drop" approach to inter-application navigation.
- E. The navigation shall be user friendly by utilizing "forward & back" capability between screens and embedded links to graphics, documents, drawings, trends, schedules, as well as external documents (.doc, .pdf, .xls, etc.) or web addresses that are related to any selected object.

- F. Primary selection of objects in the operator interface software shall be available from user defined hierarchical Views, from graphics, or from events in an Event List.
- G. Secondary selection of objects in the operator interface software shall be available from links to any objects or external documents related to the primary selection. Links to related items shall be automatically defined based on where an object is used in the system.
- H. The operator workstation shall be capable of displaying web pages and common document formats (.doc, .xls, .pdf) within the operator workstation application.
- I. The Operator workstation Software shall be capable of BACnet IP communications. The BACnet Advanced Workstation (B-AWS) shall have demonstrated interoperability during at least one BTL Interoperability Workshop, have demonstrated compliance to BTL B-AWS device classification through BTL listing as specified in ANSI/ASHRAE 135.
- J. The software shall provide a multi-tasking type environment that allows the user to run several applications simultaneously. BMS software clients shall run on a Windows XP, Windows 7 or comparable 32/64-bit operating system. System database parameters shall be stored within an object-oriented database. Standard Windows applications shall run simultaneously with the BMS software. The mouse or Alt-Tab keys shall be used to quickly select and switch between multiple applications. The operator shall be able to work in Microsoft Word, Excel, and other Windows based software packages, while concurrently annunciating on-line BMS alarms and monitoring information.
- K. The software shall provide, as a minimum, the following functionality:
 - 1. Real-time graphical viewing and control of the BMS environment.
 - 2. Reporting of both real-time and historical information.
 - 3. Scheduling and override of building operations.
 - 4. Collection and analysis of historical data.
 - 5. Point database editing, storage and downloading of controller databases.
 - 6. Configuration of and navigation through default and personalized hierarchical "tree" views that include workstation and control system objects.
 - 7. Event reporting, routing, messaging, and acknowledgment.
 - 8. Definition and construction of dynamic color graphic displays.
 - 9. Online, context-sensitive help, including an index, glossary of terms, and the capability to search help via keyword or phrase.
 - 10. On-screen access to User Documentation, via online help or PDF-format electronic file.
 - 11. Automatic database backup at the operator interface for database changes initiated at Building Controllers.
 - 12. Display dynamic trend data graphical plot.
 - a. Must be able to run multiple plots simultaneously.
 - b. Each plot must be capable of supporting 10 pts/plot minimum.
 - c. Must be able to command points from selection on dynamic trend plots.

- d. Must be able to plot real-time data without prior configuration.
 - e. Must be able to plot both real-time and historical trend data simultaneously.
 - 13. Program editing.
 - 14. Transfer trend data to third-party spreadsheet software
 - 15. Scheduling reports
 - 16. Operator Activity Log
- L. Security
- 1. Operator-specific password access protection shall be provided to allow the administrator/manager to limit users' workstation control, display and data base manipulation capabilities as deemed appropriate for each user, based upon an assigned password.
 - 2. Operator privileges shall "follow" the operator to any workstation logged onto.
 - 3. The administrator or manager shall be able to further limit operator privileges based on which console an operator is logged on to.
 - 4. The administrator or manager shall be able to grant discrete levels of access and privileges, per user, for each point, graphic, report, schedule, and BMS workstation application.
- M. The operator interface software shall include reports to track the actions of each individual operator. The application shall allow querying based on object name, operator, action, or time range.
- N. Dynamic Color Graphics application shall include the following:
- 1. Must include graphic editing and modifying capabilities.
 - 2. All necessary tools and procedures for the user to create their own graphics
 - 3. A library of standard control application graphics and symbols must be included.
 - 4. Must be able to command points directly off graphics application.
 - 5. Graphic display shall include the ability to depict real-time point values dynamically with text or animation.
 - 6. Navigation through various graphic screens shall be optionally achieved through a hierarchical "tree" structure.
 - 7. Graphics viewing shall include dynamic pan zoom capabilities.
 - 8. Graphics viewing shall include the ability to switch between multiple layers with different information on each layer.
 - 9. Graphics shall include a decluttering capability that allows layers to be programmatically hidden and displayed based on zoom level.
 - 10. Graphics shall be capable of displaying the status of points that have been overridden by a field HAND switch, for points that have been designed to provide a field HAND override capability.
 - 11. Ability to create dashboard views that graphically display system and/ or energy performance. Dashboards will consist of gauges and charts.

- O. Reports shall be generated on demand or via pre-defined schedule. As a minimum, the system shall allow the user to easily obtain the following types of reports:
1. A general listing of all or selected points in the network
 2. List of all points currently in alarm
 3. List of all points currently in override status
 4. List of all disabled points
 5. System diagnostic reports including, list of Building panels on line and communicating, status of all Building terminal unit device points
 6. List of alarm strategy definitions
 7. List of Building Control panels
 8. Point totalization report
 9. Point Trend data listings
 10. Initial Values report
 11. User activity report
 12. Event history reports
- P. Scheduling and override
1. Provide a calendar type format for simplification of time and date scheduling and overrides of building operations. Schedule definitions reside in the PC workstation and in the Building Controller to ensure time equipment scheduling when PC is off-line, PC is not required to execute time scheduling. Provide override access through menu selection, graphical mouse action or function key. Provide the following capabilities as a minimum:
 - a. Fully support all BACnet Schedule, Calendar, and Command objects.
 - b. Daily and Weekly schedules
 - c. Ability to combine multiple points into a logical Command Groups for ease of scheduling (e.g., Building 1 lights)
 - d. Schedule predefined reports.
 - e. Ability to schedule for a minimum of up to ten (10) years in advance.
 2. Additionally, the scheduling application shall:
 - a. Provide filtering capabilities of schedules, based on name, time, frequency, and schedule.
 - b. Provide sorting capabilities of schedules, based on name, time and type of schedule.
- Q. Collection and Analysis of Historical Data
1. Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-based intervals or change of value, both of which shall be user-definable. Trend data shall be collected and stored on hard disk for future diagnostics and reporting. Automatic Trend collection may be scheduled at regular intervals through the same scheduling interface as used for scheduling of equipment. Additionally, trend data may be archived to network drives or removable disk media for future retrieval.

2. System shall support trending in the same device as the monitor point or in an external device.
 3. Panels shall have a trending level above which the data will be automatically uploaded to the BMS server to prevent overwriting the data in the field panel. The trending level will be user defined in % of available space (e.g., automatically upload when the trend buffer is at 75% of allocated space).
 4. Trend data reports shall be provided to allow the user to view all trended point data. Reports may be customized to include individual points or predefined groups of selected points.
 5. Provide additional functionality that allows the user to view real-time trend data on trend graphical plot displays. A minimum of ten points may be plotted, of either real-time or historical data. The dynamic graphs shall continuously update point values. At any time the user may redefine sampling times or range scales for any point. In addition, the user may pause the display and take "snapshots" of plot screens to be stored on the workstation disk for future recall and analysis. Exact point values may be viewed and the graphs may be printed. A minimum of ten (10) dynamic graphs shall run simultaneously. Operator shall be able to command points by selecting them on the trend plot. Operator shall be able to zoom in on a specific time range within a plot.
- R. Dynamic Color Graphic Displays
1. Capability to create color graphic floor plan displays and system schematics for each piece of mechanical equipment, including, but not limited to, air handling units, chilled water systems, hot water boiler systems, and room level terminal units.
 2. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection, point alarm association, or. Graphics software shall permit the importing of AutoCAD or scanned pictures for use in the system.
 3. Dynamic temperature values, humidity values, flow values and status indication shall be shown in their actual respective locations within the system schematics or graphic floor plan displays, and shall automatically update to represent current conditions without operator intervention and without pre-defined screen refresh rates.
 - a. Provide the user the ability to display real-time point values by animated motion or custom picture control visual representation. Animation shall depict movement of mechanical equipment, or air or fluid flow. Provide users the ability to depict various positions in relation to assigned point values or ranges. A library (set) of animated symbols shall be included within the operator interface software's graphics application. Animation shall reflect, ON or OFF conditions, and shall also be optionally configurable for animation speed.
 - b. Ability to add custom gauges and charts to graphic pages.

- c. Equipment state or values can be changed by clicking on the associated point block or graphic symbol and selecting the new state (on/off) or setpoint.
 - d. State text for digital points can be user-defined.
 - 4. Colors or other visual changes shall be available to indicate status and change as the status of the equipment changes. The state colors shall be user definable.
 - 5. The Windows environment of the PC operator workstation shall allow the user to simultaneously view several applications at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.
 - 6. All required software shall be provided to allow the user to add, modify or delete system graphic background displays.
 - 7. A clipart library of HVAC application and automation symbols shall be provided including fans, valves, motors, chillers, AHU systems, standard ductwork diagrams and laboratory symbols. The user shall have the ability to add custom symbols to the clipart library. The clipart library shall include a minimum of 400 application symbols. In addition, a library consisting of a minimum of at least 100 graphic background templates shall be provided.
 - 8. The Graphics application shall include a set of standard Terminal Equipment controller application-specific background graphic templates. Templates shall provide the automatic display of a selected Terminal Equipment controller's control values and parameters, without the need to create separate and individual graphic files for each controller.
 - 9. The Graphics application shall be capable of automatically assigning the appropriate symbol for an object (point) selected to be displayed on the graphic based on what the object represents (fan, duct sensor, damper, etc.)
- S. System Configuration & Definition
 - 1. The system shall be fully configurable from clients running in a browser, installed client console, or Windows desktop app.
 - 2. Users must be able to build multiple, separate, personalized hierarchical "tree" views that represent the workstation, control systems, geographical facility layouts, and mechanical equipment relationships.
 - 3. Network wide control strategies shall not be restricted to a single Building Controller, but shall be able to include data from any and all other network panels to allow the development of Global control strategies.
 - 4. Provide automatic backup and restore of all Building Controller databases on the workstation hard disk. In addition, all database changes shall be performed while the workstation is on-line without disrupting other system operations. Changes shall be automatically recorded and downloaded to the appropriate Building Controller. Changes made at the user-interface of Building Controllers shall be automatically uploaded to the workstation, ensuring system continuity.
 - 5. System configuration, programming, editing, graphics generation shall be performed on-line from the operator workstation software.

6. User shall be able to edit point configuration online within a dedicated editor application. The editor shall allow the user to create, view existing, modify, copy, and delete points from the database.
7. User shall be able to edit point configuration of any configurable BACnet point that resides in a devices that supports external editing.
8. The software shall also allow the user to configure the alarm management strategy for each point. The editor shall provide the ability for editing the point database directly online with the Building Controllers.
9. The operator interface software shall also provide the capability to perform bulk modification of point definition attributes to a single or multiple user-selected points.
10. Control program configuration shall be available to the user within a dedicated control program editor application. The editor shall allow for creation, modification and deletion of control programs. The editor shall also include the ability to automatically compile the program to ensure its compatibility with the Building Controllers. The editor shall provide the ability to selectively enable or disable the live program execution within the Building Controllers.
11. Users shall have the ability to view the program(s) that is\are currently running in a Building Controller. The display shall mark the program lines with the following: disabled, comment, unresolved, and trace bits.

T. Event Management

1. Event Routing shall allow the user to send event notification to selected printers or workstation location(s) based on event severity, or point type.
2. Event Notification shall be presented to each workstation in a tabular format application, and shall include the following information for each event: name, value, event time and date, event status, priority, acknowledgement information, and alarm count. Each event shall have the ability to sound an audible notification based on the category of the event.
3. Event List shall have the ability to list and sort the events based on event status, point name, ascending or descending activation time.
4. Directly from the Event List, the user shall have the ability to acknowledge, silence the event sound, print, or erase each event. The interface shall also have the option to inhibit the erasing of active acknowledged events, until they have returned to normal status. The user shall also have the ability to navigate to all information related to a selected point in order to command, launch an associated graphic or trended graphical plot, or run a report on a selected point directly from the Event List.
5. Each event shall have a direct link from the Event List to further user-defined point informational data. The user shall have the ability to also associate real-time electronic annotations or notes to each event.

U. Remote Notification Software (RENO)

1. Workstations shall be configured to send out messages to numeric pagers, alphanumeric pagers, phones (via text to speech technology), SMS (Simple Messaging Service, text messaging) Devices, and email accounts based on a point's alarm condition.

2. There shall be no limit to the number of points that can be configured for remote notification of alarm conditions and no limit on the number of remote devices which can receive messages from the system.
3. On a per point basis, system shall be configurable to send messages to an individual or group and shall be configurable to send different messages to different remote devices based on alarm message priority level.
4. Remote devices may be scheduled as to when they receive messages from the system to account for operators' work schedules.
5. System must be configurable to send messages to an escalation list so that if the first device does not respond, the message is sent on to the next device after a configurable time has elapsed.
6. Message detail shall be configurable on a per user basis.
7. During a "flood" of alarms, remote notification messages shall have the ability to optimize several alarms into an individual remote notification message.
8. Workstation shall have the ability to send manual messages allowing an operator to type in a message to be sent immediately.
9. Workstation shall have a feature to send a heartbeat message to periodically notify users that they have communication with the system.

2.10 ADDITIONAL USER LICENSES

- A. Provide additional concurrent user licenses as called for here or in the Sequence of Operations. Every Operator Interface called for or shown on the Network Architecture shall have its own concurrent user license such that all can be on-line at the same time.
- B. Additional concurrent user licenses shall be provided as required by the County of San Bernardino.
- C. A user license shall have the same features and capabilities as the Server license. Usernames and passwords shall control the access to these features.

2.11 ELECTRONIC DOCUMENTATION

- A. Provide software applications and files to view documentation through the GUI.
- B. Provide a CAD viewer to view all project AutoCAD documents that are made available by the Architect and Owner.
- C. Provide all controls cut sheets in PDF format. Make them available to any user accessing the system over the Internet.
- D. Provide a text version of the sequence of operation. Make the written sequence available from the graphic that represents each system. The sequence shall pop up in a printable format such as HTML or PDF.

2.12 CONTROLLER SOFTWARE (I.E. BUILDING CONTROLLER SOFTWARE, , DDC SOFTWARE, FIELD PANEL SOFTWARE)

- A. Provide a full capability user license to the owner for the operator to be able to see, modify, create, upload, download and save control programs to the DDC controllers.
- B. The software program shall be provided as an integral part of DDC Controllers and shall not be dependent upon any higher level computer or another controller for execution.
- C. The software application shall be accessible from a PC using the Windows environment, but shall use all of its own services and data files so as to not be susceptible to Microsoft Windows operating systems based viruses.
- D. The software shall be provided with an interactive HELP function to assist operators with syntax, abbreviations, commands and saving programs.
- E. Point naming and communication format:
 - 1. All points, panels, and programs shall be identified by a 30-character name. All points shall also be identified by a 16-character point descriptor. The same names shall be displayed at both Building Controller and the Operator Interface.
 - 2. All digital points shall have a consistent, user-defined, two-state status indication with 8 characters minimum (e.g., Summer, Enabled, Disabled, Abnormal).
 - 3. The Building Controller Software shall be capable of BACnet communications. The BACnet Building Controller (B-BC) shall have demonstrated interoperability during at least one BTL Interoperability Workshop, have demonstrated compliance to BTL through BTL listing and shall substantially conform to BACnet Building Controller (B-BC) device profile as specified in ANSI/ASHRAE 135-2004, Annex L.
- F. System Security
 - 1. User access shall be secured using individual security passwords and user names.
 - 2. Passwords shall restrict the user to the objects, applications, and system functions as assigned by the system manager.
 - 3. Building Controllers shall be able to assign a minimum of 50 passwords access and control priorities to each point individually. The logon password (at any Operator Interface or portable operator terminal) shall enable the operator to monitor, adjust and control only the points that the operator is authorized for. All other points shall not be displayed at the Operator Interface or portable terminal. Passwords and priorities for every point shall be fully programmable and adjustable.
 - 4. User Log On/Log Off attempts shall be recorded.
 - 5. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user-definable.

6. Use of workstation resident security as the only means of access control is not an acceptable alternative to resident system security in the DDC controller software.
- G. User Defined Control Applications: The applications software shall program DDC routines to meet the sequences of operations.
 1. Building Controllers shall have the ability to perform energy management routines including but not limited to time of day scheduling, calendar-based scheduling, holiday scheduling, temporary schedule overrides, start stop time optimization, automatic daylight savings time switch over, night setback control, enthalpy switch over, peak demand limiting, temperature-compensated duty cycling, heating/cooling interlock, supply temperature reset, priority load shedding, and power failure restart.
 2. The Building Controllers shall have the ability to perform the following pre tested control algorithms:
 - a. Two position with differential control and time delays
 - b. Floating control
 - c. Proportional control
 - d. Proportional plus integral control
 - e. Proportional, integral, plus derivative control
 - f. Automatic tuning of control loops
 - g. Model-free adaptive control
 3. Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
 4. Each controller shall support plain language text comment lines in the operating program to allow for quick troubleshooting, documentation, and historical summaries of program development.
- H. Peer-to-peer access to other DDC controllers
 1. It shall be possible to use any actual or virtual point data or status, any system calculated data, a result from any process, or any user-defined constant in any controller in the system.
 2. Any process shall be able to issue commands to points in any and all other controllers in the system.
 3. Processes shall be able to generate operator messages and advisories to other operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of an advanced annunciation feature, such as:
 - a. Generate a report
 - b. Annunciate an alarm
 - c. Issue a text message or email
- I. Alarm Management
 1. Alarm management shall be provided within the controller software to monitor and direct alarm information to operator devices.
 2. Each Building Controller shall perform distributed, independent alarm analysis, minimize network traffic and prevent alarms from being lost. At no time shall the Building Controllers ability to report alarms be affected

by either operator or activity at a PC workstation, local I/O device or communications with other panels on the network.

3. Conditional alarming shall allow generation of alarms based upon user defined multiple criteria.
4. An Alarm "shelving" feature shall be provided to disable alarms during testing. (Pull the Plug, etc.).
5. Binary Alarms. Each binary alarm object shall be set to alarm based on the operator-specified state. Provide the capability to automatically and manually disable alarming.
6. Analog Alarms. Each analog alarm object shall have both high and low alarm limits. Alarming must be able to be automatically and manually disabled.
7. All alarm shall include the point's user-defined language description and the time and date of occurrence.
8. Alarm reports and messages shall be routed to user-defined list of operator workstations, or other devices based on time and other conditions. An alarm shall be able to start programs, print reports, be logged in the event log, generate custom messages, and display graphics.
9. The user shall be able to add a 200-character alarm message to each alarm point to more fully describe the alarm condition or direct operator response. Each Building Controller shall be capable of storing a library of at least 50 alarm messages. Each message may be assigned to any number of points in the Controller.
10. Operator-selected alarms shall be capable of initiating a trigger to an advanced annunciation, such as text, email, etc.
11. An alarm history log shall report the start of the alarm condition, acknowledgement by a user and return of the alarm to normal condition.

J. Scheduling:

1. Provide a comprehensive menu driven program to automatically start and stop designated multiple objects or events in the system according to a stored time.
2. Schedules shall reside in the building controller and shall not rely on external processing or network.
3. It shall be possible to define a group of objects as a custom event (i.e., meeting, athletic activity, etc.). Events can then be scheduled to operate all necessary equipment automatically.
4. For points assigned to one common load group, it shall be possible to assign variable time delays between each successive start and/or stop within that group.
5. The operator shall be able to define the following information:
 - a. Time, day
 - b. Commands such as on, off, auto, etc.
 - c. Time delays between successive commands.
 - d. There shall be provisions for manual overriding of each schedule by an authorized operator.
6. It shall be possible to schedule calendar-based events up to one year in advance based on the following:

- a. Weekly Schedule. Provide separate schedules for each day of the week. Each of these schedules should include the capability for start, stop, optimal start, optimal stop, and night economizer. When a group of objects are scheduled together as an Event, provide the capability to adjust the start and stop times for each member.
 - b. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed, it will be discarded and replaced by the standard schedule for that day of the week.
- K. Peak Demand Limiting (PDL):
 - 1. The Peak Demand Limiting (PDL) program shall limit the consumption of electricity to prevent electrical peak demand charges.
 - 2. PDL shall continuously track the amount of electricity being consumed, by monitoring one or more electrical kilowatt-hour/demand meters. These meters may measure the electrical consumption (kWh), electrical demand (kW), or both.
 - 3. PDL shall sample the meter data to continuously forecast the demand likely to be used during successive time intervals.
 - 4. If the PDL forecasted demand indicates that electricity usage is likely to exceed a user preset maximum allowable level, then PDL shall automatically shed electrical loads.
 - 5. Once the demand peak has passed, loads that have been shed shall be restored and returned to normal control.
- L. Temperature-compensated duty cycling
 - 1. User defined conditions shall be able to initiate a Duty Cycle Control Program.
 - 2. The Duty Cycle Control Program (DCCP) shall be configured to periodically stop and start loads according to various patterns.
 - 3. The loads shall be cycled such that there is a net reduction in both the electrical demands and the energy consumed.
- M. Automatic Daylight Savings Time Switchover. The system shall provide automatic time adjustment for switching to/from Daylight Savings Time.
- N. Night setback control. The system shall provide the ability to automatically adjust setpoints for night control.
- O. Enthalpy switchover (economizer). The Building Controller Software (BCS) shall control the position of the air handler relief, return, and outside air dampers. If the outside air dry bulb temperature falls below changeover setpoint the BCS will modulate the dampers to provide 100 percent outside air. The user will be able to quickly change over to an economizer system based on dry bulb temperature and will be able to override the economizer cycle and return to minimum outside air operation at any time.

- P. Control Loop Algorithm
1. Provide a PID (proportional-integral-derivative) closed-loop control algorithm with direct or reverse action and anti-windup. The algorithm shall calculate a time-varying analog value that is used to position an output or stage a series of outputs. The controlled variable, setpoint, and weighting parameters shall be accessible from the operator workstation.
- Q. Adaptive Loop Tuning
1. Building Controllers shall also provide high resolution sampling capability for verification of DDC control loop performance. Documented evidence of tuned control loop performance shall be provided on a monthly, seasonal, quarterly, annual period.
 2. For Model-Free Adaptive Control loops, evidence of tuned control loop performance shall be provided via graphical plots or trended data logs. Graphical plots shall minimally include depictions of setpoint, process variable (output), and control variable (e.g., temperature). Other parameters that may influence loop control shall also be included in the plot (e.g., fan on/off, mixed-air temp).
 3. For PID control loops, operator-initiated automatic and manual loop tuning algorithms shall be provided for all operator-selected PID control loops. Evidence of tuned control loop performance shall be provided via graphical plots or trended data logs for all loops.
 - a. In automatic mode, the controller shall perform a step response test with a minimum one-second resolution, evaluate the trend data, calculate the new PID gains and input these values into the selected LOOP statement.
 - b. Loop tuning shall be capable of being initiated either locally at the Building Controller, from a network workstation or remotely using dial-in modems. For all loop tuning functions, access shall be limited to authorized personnel through password protection.
- R. Logic programming: Provide a software routine that can build ladder logic to control using many conditional statements.
1. The logic programming syntax shall be able to combine ladder logic with other software features, such as combining status, scheduling, PDL and alarm conditions into one conditional decision.
 2. Logic programming shall be able to reference conditions in any other controller in the system.
- S. Staggered Start:
1. This application shall prevent all controlled equipment from simultaneously restarting after a power outage. The order in which equipment (or groups of equipment) is started, along with the time delay between starts, shall be user definable in an application and shall not require written scripts or ladder logic.
 2. Upon the resumption of power, each Building Controller shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling and turn equipment on or off as necessary to resume normal operations.

- T. Totalization Features:
1. Run-Time Totalization. Building Controllers shall automatically accumulate and store run-time hours for all digital input and output points. A high runtime alarm shall be assigned, if required, by the operator.
 2. Consumption totalization. Building Controllers shall automatically sample, calculate and store consumption totals on a daily, weekly or monthly basis for all analog and digital pulse input type points.
 3. Event totalization. Building Controllers shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly or monthly basis for all points. The event totalization feature shall be able to store the records associated with events before reset.
- U. Data Collection:
1. A variety of historical data collection utilities shall be provided to manually or automatically sample, store, and display system data for all points.
 2. Building Controllers shall store point history data for selected analog and digital inputs and outputs:
 3. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each Building Controllers point group.
 4. Two methods of collection shall be allowed: either by up to four pre-defined time intervals or upon a pre-defined change of value. Sample intervals of 1 minute to 7 days shall be provided.
 5. Each Building Controller shall have a dedicated RAM-based buffer for trend data and shall be capable of storing a minimum of 10,000 data samples.
 6. Trend data shall be stored at the Building Controllers and uploaded to the workstation when retrieval is desired. Uploads shall occur based upon either user-defined interval, manual command or when the trend buffers are full. All trend data shall be available for use in third-party personal computer applications.

2.13 BUILDING CONTROLLERS (B-BC)

- A. Provide all necessary hardware for a complete operating system as required. The Building Controller shall be able to operate as a standalone panel and shall not be dependent upon any higher level computer or another controller for operation.
- B. Basis of design is Siemens PX Modular and Compact Controllers (PXC).
- C. This controller shall have the BTL listing and meet the BACnet device profile of a Building Controller (B-BC) and shall support the following BACnet BIBBs:
1. Data Sharing
 - a. Data Sharing-Read Property-Initiate, Execute (DS-RP-A,B)
 - b. Data Sharing-Read Property Multiple- Initiate, Execute (DS-RPM-A,B)
 - c. Data Sharing-Write Property- Initiate, Execute (DS-WP-A,B)

- d. Data Sharing-Write Property Multiple- Execute (DS-WPM-B)
- e. Data Sharing-COV- Initiate, Execute (DS-COV-A,B)
- f. Data Sharing-COV-Unsolicited- Initiate, Execute (DS-COVU-A,B)
2. Scheduling
 - a. Scheduling-Internal- Execute (SCHED-I-B)
 - b. Scheduling-External- Execute (SCHED-E-B)
3. Trending
 - a. Trending-Viewing and Modifying Trends - Initiate (T-VMT-A)
 - b. Trending-Viewing and Modifying Trends Internal- Execute (T-VMT-I-B)
 - c. Trending-Viewing and Modifying Trends-External- Execute (T-VMT-E-B)
 - d. Trending-Automated Trend Retrieval- Execute (T-ATR-B)
4. Network Management
 - a. Network Management-Connection Establishment- Initiate (NM-CE-A)
5. Alarming
 - a. Alarm and Event-Notification- Initiate (AE-N-A)
 - b. Alarm and Event-Notification Internal- Execute (AE-N-E-B)
 - c. Alarm and Event-Notification External- Execute (AE-N-E-B)
 - d. Alarm and Event-ACK- Initiate, Execute (AE-ACK-A,B)
 - e. Alarm and Event –Alarm Summary- Execute (AE-ASUM-B)
 - f. Alarm and Event –Enrollment Summary- Execute (AE-ESUM-A,B)
 - g. Alarm and Event –Information- Initiate, Execute (AE-ESUM-A,B)
6. Device Management
 - a. Device Management-Dynamic Device Binding- Initiate, Execute (DM-DDB-A,B)
 - b. Device Management-Dynamic Object Binding- Initiate, Execute (DM-DOB-A,B)
 - c. Device Management-Device Communication Control- Execute (DM-DCC-B)
 - d. Device Management-Private Transfer- Initiate, Execute (DM-PT-A,B)
 - e. Device Management-Text Message- Initiate, Execute (DM-TM-A,B)
 - f. Device Management-Time Synchronization- Execute (DM-TS-B)
 - g. Device Management-Reinitialize Device- Execute (DM-RD-B)
 - h. Device Management-Backup and Restore- Execute (DM-RD-B)
 - i. Device Management-List Manipulation- Execute (DM-RD-B)
 - j. Device Management-Object Creation and Deletion- Execute (DM-OCD-B)
7. The Building Level Controller shall support the following Data Link Layers:
 - a. BACnet IP Annex J
 - b. BACnet IP Annex J Foreign Device
 - c. MS/TP Master (Claus 9)
8. The Building Level Controller shall be able to interact with all of the BACnet objects in the controllers. In addition, the software shall be able to

support the following objects as they relate to features in the workstation software:

- a. Calendar – Creatable, Deletable
 - b. Command – Creatable, Deletable
 - c. Event Enrollment – Creatable, Deletable
 - d. Notification Class – Creatable, Deletable
 - e. Schedule - Creatable, Deletable
9. The Building Level Controller shall support transmitting and receiving segmented messages.
 10. The Building Level Controller shall have the capability to be the BACnet/IP Broadcast Management Device (BBMD) and support foreign devices.
 11. The Building Level Controller shall have the capability to act as a BACnet router between MS/TP subnetworks and BACnet/IP.
- D. This level of controller shall be used for the following types of systems:
1. Air handlers over 15,000 cfm
 2. Systems with over 24 input/output points
- E. Computing power and memory minimum:
1. A 32-bit, stand-alone, multi-tasking, multi-user, real-time 100MHz digital control microprocessor module.
 2. Inputs shall be 16-bit minimum analog-to-digital resolution
 3. Outputs shall be 10-bit minimum digital-to-analog resolution
 4. Memory module (24 Megabyte, minimum) to accommodate all Primary Control Panel software requirements, including but not limited to, its own operating system and databases (see Controllers Software section), including control processes, energy management applications, alarm management applications, historical/trend data for points specified, maintenance support applications, custom processes, operator I/O, dial-up communications.
 5. Real time clock and battery
 6. Data collection/ Data Trend module sized for 10,000 data samples.
 7. Flash Memory Firmware: Each Building Level Control Panel shall support firmware upgrades without the need to replace hardware.
- F. Onboard or Modular hardware and connections:
1. Primary Network communication module, if needed for primary network communications.
 2. Secondary Network communication module, if needed for secondary network communications.
 3. RJ45 port 10/100Mbaud
 4. RS485 ports for subnetworks and point expansion
 5. Man to Machine Interface port (MMI)
 6. USB Port
- G. Input and Output Points Hardware
1. Input/output point modules as required including spare capacity.
 2. Monitoring of the status of all hand-off-auto switches.

3. Monitoring of all industry standard types of analog and digital inputs and outputs, without the addition of equipment to the primary control panel.
 4. Local status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Each primary control panel shall perform diagnostics on all inputs and outputs and a failure of any input or output shall be indicated both locally and at the operator workstation.
 5. Graduated intensity LEDs or analog indication of value for each analog output.
- H. Code compliance
1. Approvals and standards: UL916; CE; FCC
 2. Provide UL864-UUKL where called for in the sequences of operations.
- I. Accessories:
1. Appropriate NEMA rated metal enclosure.
 2. Power supplies as required for all associated modules, sensors, actuators, etc.
- J. Keypad.
1. Where called for in the sequence of operation, or on the plans, a local keypad and display shall be provided for each controller. The keypad shall be provided for interrogating and editing data. An optional system security password shall be available to prevent unauthorized use of the keypad and display.
- K. The operator shall have the ability to manually override automatic or centrally executed commands at the primary control panels via local, point discrete, on-board hand/off/auto operator override switches. If on board switches are not available, provide separate control panels with HOA switches. Mount panel adjacent to primary control panel. Provide hand/off/auto switch for each digital output, including spares.
- L. Each Building Level Control Panel shall continuously perform self-diagnostics on all hardware modules and network communications. The System Level Control Panel shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication with any system.
- M. Panel setup, point definitions and sequencing diagrams shall be backed up on EEPROM memory.
- N. Power loss. In the event of the loss of power, there shall be an orderly shutdown of all Building Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 30 days.

- O. Building Level control panels shall provide at least two serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. Primary control panels shall allow temporary use of portable devices without interrupting the normal communications, operation of permanently connected modems, printers or terminals.
- P. Building Level Controllers shall have the capability to serve as a gateway between Modbus subnetworks and BACnet objects. Provide software, drives and programming.
- Q. Isolation shall be provided at all primary control panel terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standards 587-1980.
- R. Spare Capacity: Provide enough inputs and outputs to handle the equipment shown to be "future" on drawings and 10% more of each point type. Provide all hardware modules, software modules, processors, power supplies, communication controllers, etc. required to ensure adding a point to the spare point location only requires the addition of the appropriate sensor/actuator and field wiring/tubing.
- S. Environment.
1. Controller hardware shall be suitable for the anticipated ambient conditions.
 2. Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures and shall be rated for operation at 0°C to 49°C (32°F to 120°F).
 3. Controllers used in conditioned space shall be mounted in dust-proof enclosures and shall be rated for operation at 0°C to 49°C (32°F to 120°F).
- T. Immunity to power and noise.
1. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.
 2. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).
 3. Isolation shall be provided at all primary network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:
 - a. RF-Conducted Immunity (RFCI) per ENV 50141 (IEC 1000-4-6) at 3V.
 - b. Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact.
 - c. Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500V signal, 1 kV power.
 - d. Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max).
 4. Isolation shall be provided at all Building Controller's AC input terminals to suppress induced voltage transients consistent with:

- a. IEEE Standard 587 1980
- b. UL 864 Supply Line Transients
- c. Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)

2.14 ADVANCED APPLICATION CONTROLLERS

- A. Provide all necessary hardware for a complete operating system as required. The Advanced Application level control panel shall be able to operate as a standalone panel and shall not be dependent upon any higher level computer or another controller for operation.
- B. Basis of design is Unitary Equipment Controller (PXCxx-UCM).
- C. The Advanced Application Controller Software shall be capable of BACnet communications. The BACnet Advanced Application Controller (B-AAC) shall have demonstrated compliance to BTL through BTL listing and shall substantially conform to BACnet Advanced Application Controller (B-AAC) device profile as specified in ANSI/ASHRAE 135-2004 or ANSI/ASHRAE 135-2008. Supported BIBBS shall include:
 1. Data Sharing
 - a. Data Sharing-Read Property-Initiate, Execute (DS-RP-A,B)
 - b. Data Sharing-Read Property Multiple- Initiate, Execute (DS-RPM-A,B)
 - c. Data Sharing-Write Property- Initiate, Execute (DS-WP-A,B)
 - d. Data Sharing-Write Property Multiple- Execute (DS-WPM-B)
 - e. Data Sharing-COV- Initiate, Execute (DS-COV-A,B)
 2. Scheduling
 - a. Scheduling-Internal- Execute (SCHED-I-B)
 3. Trending
 - a. Trending-Viewing and Modifying Trends Internal- Execute (T-VMT-I-B)
 - b. Trending-Automated Trend Retrieval- Execute (T-ATR-B)
 4. Network Management
 - a. Network Management-Connection Establishment- Initiate (NM-CE-A)
 5. Alarming
 - a. Alarm and Event-Notification Internal- Execute (AE-N-I-B)
 - b. Alarm and Event-ACK- Initiate, Execute (AE-ACK-A,B)
 - c. Alarm and Event –Enrollment Summary- Execute (AE-ESUM-B)
 - d. Alarm and Event –Information- Execute (AE-INFO-B)
 6. Device Management
 - a. Device Management-Dynamic Device Binding- Initiate, Execute (DM-DDB-A,B)
 - b. Device Management-Dynamic Object Binding- Initiate, Execute (DM-DOB-A,B)
 - c. Device Management-Device Communication Control- Execute (DM-DCC-B)
 - d. Device Management-Time Synchronization- Execute (DM-TS-B)

- e. Device Management-Reinitialize Device- Execute (DM-RD-B)
 - f. Device Management-Backup and Restore- Execute (DM-BR-B)
 - g. Device Management-List Manipulation- Execute (DM-LM-B)
 - h. Device Management-Object Creation and Deletion- Execute (DM-OCD-B)
 - 7. The Advanced Application Controller shall be able to interact with all of the BACnet objects in the controllers. In addition, the software shall be able to support the following objects as they relate to features in the workstation software:
 - a. Calendar – Creatable, Deletable
 - b. Command – Creatable, Deletable
 - c. Event Enrollment – Creatable, Deletable
 - d. Notification Class – Creatable, Deletable
 - e. Schedule - Creatable, Deletable
 - 8. The Advanced Application Controller shall support transmitting and receiving segmented messages.
- D. Communication:
- 1. BAS Network: The Advanced Application Controller shall support the following Data Link Layers:
 - a. MS/TP Master
 - 2. Serial Communication: Temporary use of portable devices shall not interrupt the BAS communication, nor the normal operation of permanently connected printers or terminals.
 - a. Provide at least one EIA-232C serial data communication port for operation of operator I/O devices such as industry standard printers, operator terminals, and portable laptop operator's terminals.
 - b. A USB port shall alternatively be available to support local HMI tools connection.
- E. Software
- 1. The software programs specified in this section shall be provided as an integral part of Advanced Application Controllers and shall not be dependent upon any higher level computer or another controller for execution.
 - 2. Advanced Application Controllers shall have the ability to perform energy management routines including but not limited to
 - a. scheduling, calendar-based scheduling, holiday scheduling, temporary schedule overrides
 - b. automatic daylight savings time switch over
 - c. night setback control
 - d. economizer switch over using enthalpy, dry bulb or a combination
 - e. peak demand limiting,
 - f. temperature-compensated duty cycling
 - g. heating/cooling interlock
 - h. supply temperature reset
 - i. priority load shedding
 - j. power failure restart
 - 3. The software shall have a routine for automatic tuning of control loops

4. System Security in the Field Panel
 - a. User access shall be secured using individual security passwords and user names.
 - b. Passwords shall restrict the user to the objects, applications, and system functions as assigned by the system manager.
 - c. The system shall protect itself from unauthorized use by automatically logging off following the last keystroke. The delay time shall be user-definable.
 - d. Use of workstation resident security as the only means of access control is not an acceptable alternative to resident system security in the field panel.
 5. User Defined Control Applications:
 - a. Controllers shall be fully-programmable. Controllers shall execute custom, job-specific sequences to automatically perform calculations and special control routines. Factory installed or pre-configured sequences shall only be allowed if they exactly match the sequence specified herein.
 - b. Programs shall combine control logic, control loop algorithms, and energy management routines
 - c. Each controller shall support plain language text comment lines in the operating program to allow for quick troubleshooting, documentation, and historical summaries of program development.
 - d. Controller shall provide a HELP function key, providing enhanced context sensitive on-line help with task oriented information from the user manual.
- F. Adaptive Loop Control.
1. Each AAC controller shall come standard with an Adaptive Control Loop Algorithm
 - a. Tuning parameter shall automatically adjust for non-linear applications
 2. Model-Free Adaptive (MFA) algorithm
 - a. The algorithm shall not require modeling of the non-linear system in order to maintain control at all points of the non-linear load.
 - b. The controlled variable, setpoint, and weighting parameters shall be user-selectable.
 3. Output shall be analog or shall stage a series of outputs.
 4. Adaptive Control shall take the place of Proportional, Proportional + Integral, and PID type algorithms for non-linear applications. Adaptive Control routines shall :
 - a. Improve response time
 - b. Improve System efficiency
 - c. Improve Stability
 - d. Result in Consistent outputs
 - e. Reduce cycling and repositioning
 - f. Reduce wear and tear on actuators
 5. Adaptive control shall auto-adjust to compensate for
 - a. mode changes

- b. load changes
 - c. seasonal changes
 - d. Heating and cooling changeover
 - e. Heating or cooling capacity changes on the primary side
 - f. Flow changes on the primary or secondary side
 - g. Airflow changes across coil
 - h. Flow across a heat exchanger
- 6. Adaptive control shall auto-adjust to compensate for
 - a. Duct Static reset routines
- 7. Auto-Tune PID loops are not acceptable substitutions.
- 8. If Adaptive Loop Control is not available, then the BAS contractor shall provide re-tuning of the control loops for coils and heat exchangers for each of the following conditions:
 - a. Dual temperature systems tune for heating and cooling modes
 - b. Each of 4 seasons
- G. This level of controller shall be used for the following types of systems:
 - 1. Systems with custom sequences that meet all of the criteria below:
 - 2. Air handlers up to 15,000 cfm
 - 3. Systems up to 20 input/output points
 - 4. Room control sequences that do not fit into an ASC controller
 - 5. BAS Network or Architecture or Sequences do not require the system to be on an IP network
 - 6. No systems that require integration to meters, VFDs or other smart equipment
 - 7. Integration to smart thermostats is allowed
- H. Input/Outputs
 - 1. Inputs shall be 16-bit minimum digital resolution
 - 2. Outputs shall be 10-bit minimum digital resolution
 - 3. The following I/O port types shall be available on the controller
 - a. Universal Input (software configurable):
 - 1) Digital Input choices:
 - a) Pulse Accumulator
 - b) Contact Closure Sensing
 - c) Dry Contact/Potential Free inputs only
 - d) Digital Input (10 ms settling time)
 - e) Counter inputs up to 20 Hz, minimum pulse duration 20 ms (open or closed)
 - 2) Analog Input Choices:
 - a) 0-10 Vdc
 - b) 4-20 mA
 - c) 1K Ni RTD @ 32°F (Siemens, JCI, DIN Ni 1K)
 - d) 1K Pt RTD (375 or 385 alpha) @ 32°F
 - e) 10K NTC Type 2 or Type 3 Thermistor
 - f) 100K NTC Type 2 Thermistor
 - b. Universal Input or Output (software configurable):
 - 1) All of the above input types
 - 2) Analog Output Types:

- a) 0 to 10 Vdc @ 1 mA max
 - c. Super Universal Input or Output (software configurable):
 - 1) All of the above input types
 - 2) All of the above output types
 - 3) Super digital output type:
 - a) 0 to 24 Vdc, 22 mA max. (for controlling pilot relay)
 - 4) Super Analog Output Choices:
 - a) 0 to 20 mA @ 650 Ω max.
 - 4. Provide software configurable I/O ports such that a programmer make a port either an input or an output
- I. Each System Level Control Panel shall, at a minimum, be provided with:
- 1. Appropriate NEMA rated metal enclosure.
 - 2. A 32-bit,multi-tasking, real-time 100 MHz digital control microprocessor with plug-in, enclosed processors.
 - 3. Each Advanced Application Controller shall have sufficient memory, a minimum of 24 megabyte, to support its own operating system and data-bases, including control processes, energy management applications, alarm management applications, historical/trend data for points specified, maintenance support applications, custom processes, and operator I/O.
 - 4. Real time clock and battery
 - 5. Data collection/ Data Trend module sized for 10,000 data samples.
 - 6. Power supplies as required for all associated modules, sensors, actuators, etc.
 - 7. Monitoring of all industry standard types of analog and digital inputs and outputs, without the addition of equipment to the primary control panel.
 - 8. Local status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device.
 - 9. Each control panel shall perform diagnostics on all inputs and outputs and a failure of any input or output shall be indicated both locally and at the operator workstation.
 - 10. Graduated intensity LEDs or analog indication of value for each analog output.
- J. Power loss. In the event of the loss of power, there shall be an orderly shutdown of all controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for the operating system software and firmware.
- 1. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.
 - 2. Brownout protection and power recovery circuitry protect the controller board from power fluctuations.
 - 3. Battery backup shall be provided to support the real-time clock for 10 years
 - 4. The program and database information stored SDRAM memory shall be battery backed for a minimum of 30 days and up to 60 days. This eliminates the need for time consuming program and database re-entry in the event of an extended power failure.

- K. Database Restore: Each AAC controller shall automatically save the latest programmed database. The controller shall be able to automatically restore a lost or corrupt database without involvement from the operator.
- L. Each System Level Control Panel shall continuously perform self-diagnostics on all hardware modules and network communications. The System Level Control Panel shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication with any system.
- M. Each Control Panel shall support firmware upgrades without the need to replace hardware.
1. The AAC level controller shall be upgradable to a BC level controller with a flash upgrade of the firmware.
- N. System Level control panels shall provide at least two RS-232C serial data communication ports for operation of operator I/O devices such as operator terminals, and additional memory. Control panels shall allow temporary use of portable operator interface devices without interrupting the normal communications.
- O. Immunity to noise.
1. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m (3 ft).
 2. Isolation shall be provided at all primary network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:
 - a. RF-Conducted Immunity (RFCI) per ENV 50141 (IEC 1000-4-6) at 3V.
 - b. Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact.
 - c. Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500V signal, 1 kV power.
 - d. Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max).
 3. Isolation shall be provided at all Advanced Application Controller's AC input terminals to suppress induced voltage transients consistent with:
 - a. IEEE Standard 587 1980
 - b. Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)
- P. Agency Compliance
1. UL UL916 PAZX (all models)
 2. UL916 PAZX7 (all models)
 3. FCC Compliance CFR47 Part 15, Subpart B, Class B
 4. Australian EMC Framework
 5. European EMC Directive (CE)
 6. European Low Voltage Directive (LVD)
 7. BACnet Testing Laboratories (BTL) Certified

- Q. Spare Capacity: Provide enough inputs and outputs to handle the equipment shown to be "future" on drawings and 10% more of each point type. Provide all hardware modules, software modules, processors, power supplies, communication controllers, etc. required to ensure adding a point to the spare point location only requires the addition of the appropriate sensor/actuator and field wiring/tubing.
- R. Local Operator Interfaces: Provide if called for elsewhere in the specification or the sequences of operations.
 - 1. Controllers shall support an optional Operator Interface Module.

2.15 APPLICATION SPECIFIC CONTROLLERS

- A. Each Application Level Control Panel shall operate as a stand-alone controller capable of performing its user selectable control routines independently of any other controller in the system. Each application specific controller shall be a microprocessor-based, multi-tasking, real-time digital control processor.
- B. Basis of design is Siemens BTEC controller.
- C. This controller shall have the BTL listing and meet the BACnet device profile of an Application Specific Controller and shall support the following BACnet BIBBs:
 - 1. Data Sharing
 - a. Data Sharing-Read Property-B (DS-RP-B)
 - b. Data Sharing-Read Property Multiple-B (DS-RPM-B)
 - c. Data Sharing-Write Property-B (DS-WP-B)
 - 2. Device Management
 - a. Device Management-Dynamic Device Binding-B (DM-DDB-B)
 - b. Device Management-Dynamic Object Binding-B (DM-DOB-B)
 - c. Device Management-Device Communication Control-B (DM-DCC-B)
 - 3. The Advanced Application Controller shall support the following Data Link Layers:
 - a. MS/TP Master or Slave (Claus 9)
- D. Provide a Application Specific Control Panel for each of the following types of equipment (if applicable):
 - 1. Fan coil Units
 - 2. Supplemental AC units
 - 3. Other terminal equipment
- E. Each Application Specific Controller shall, at a minimum, be provided with:
 - 1. Appropriate NEMA rated enclosure
 - 2. Floor Level network communications ability
 - 3. Power supplies as required for all associated modules, sensors, actuators, etc.
 - 4. Software as required for all sequences of operation, logic sequences and energy management routines.
 - 5. A portable operator terminal connection port

6. Auxiliary enclosure for analog output transducers, isolation relays, etc. Auxiliary enclosure shall be part of primary enclosure or mounted adjacent primary enclosure
 7. Each controller measuring air volume shall include provisions for manual and automatic calibration of the differential pressure transducer in order to maintain stable control and insuring against drift over time
 8. Each controller measuring air volume shall include a differential pressure transducer
 9. Approvals and standards: UL916; CE; FCC
- F. Each Application Specific Controller shall continuously perform self-diagnostics on all hardware and secondary network communications. The Application Specific Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failure to establish communication to the system.
- G. Provide each Application Specific Controller with sufficient memory to accommodate point databases, operating programs, local alarming and local trending. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM. The controllers shall be able to return to full normal operation without user intervention after a power failure of unlimited duration. Provide uninterruptible power supplies (UPSs) of sufficient capacities for all terminal controllers that do not meet this protection requirement. Operating programs shall be field-selectable for specific applications. In addition, specific applications may be modified to meet the user's exact control strategy requirements, allowing for additional system flexibility. Controllers that require factory changes of all applications are not acceptable.
- H. The Application Specific Controller shall be powered from a 24 VAC source provided by this contractor and shall function normally under an operating range of 18 to 28 VAC (-25% to +17%), allowing for power source fluctuations and voltage drops. Install plenum data line and sensor cable in accordance with local code and NEC. The controllers shall also function normally under ambient conditions of 32 to 122 F (0 to 50 C) and 10% to 95%RH (non-condensing). Provide each controller with a suitable cover or enclosure to protect the intelligence board assembly.

2.16 ROUTERS

- A. Provide a router for each subnetwork to connect the floor level network to the base building backbone level network. The router shall connect BACnet MS/TP subnetworks to BACnet over Ethernet.
- B. The router shall be capable of handling all of the BACnet BIBBs that are listed for the controller that reside on the subnetwork.

2.17 BASE BUILDING BACKBONE PORTS

- A. On each floor, wing or major mechanical room provide an Ethernet RJ45 connection that allows connection to the BACnet network. An open port shall always be available and shall not require any part of the network to be disconnected. The location shall be accessible to the base building personnel and not in a location where the tenant can restrict the access.

2.18 CONTROL PANELS

- A. Controllers in mechanical rooms shall be mounted in NEMA 1 enclosures.
- B. Mount on walls at an approved location or provide a free standing rack.
- C. Panels shall be constructed of 16 gauge, furniture-quality steel, or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with ANSI 61 gray polyester-powder painted finish, UL listed. Provide common keying for all panels.
- D. Provide power supplies for control voltage power.
- E. Dedicate 1 power supply to the DDC controller. Other devices shall be on a separate power supply, unless the power for the control device is derived from the controller terminations.
- F. Power supplies for controllers shall be a transformer with a fuse or circuit breaker. Power supplies for other devices can be plain transformers.
- G. All power supplies for 24V low voltage wiring shall be class 2 rated and less than 100VA. If low voltage devices require more amps, then provide multiple power supplies. If a single device requires more amps, then provide a dedicated power supply in a separate enclosure and run a separate, non-class 2 conduit to the device.
- H. Surge transient protection shall be incorporated in design of system to protect electrical components in all DDC Controllers and operator's workstations.
- I. All devices in a panel shall be permanently mounted, including network switches, modems, media converters, etc.
- J. Provide a pocket to hold documentation.

2.19 GENERAL SPECIFICATIONS FOR DEVICES

- A. Provide mounting hardware for all devices, including actuator linkages, wells, installation kits for insertion devices, wall boxes and fudge plates, brackets, etc.
- B. If a special tool is required to mount a device, provide that tool.

2.20 SENSORS

A. Terminal Unit Space Thermostats

1. Each controller performing space temperature control shall be provided with a matching room temperature sensor.
 - a. Plain Space Temperature Sensors – Wired: Where called for in the sequences or on the drawings, provide sensors with plain covers.
 - b. The sensing element for the space temperature sensor shall be thermistor type providing the following.
 - 1) Element Accuracy: + /- 1.0°F
 - 2) Operating Range: 55 to 95°F
 - 3) Set Point Adjustment Range: 55 to 95°F
 - 4) Calibration Adjustments: None required
 - 5) Installation: Up to 100 ft. from controller
 - 6) Auxiliary Communications Port: as required
 - 7) Local LCD Temperature Display: as required
 - 8) Setpoint Adjustment Dial as required
 - 9) Occupancy Override Switch as required
 - c. Auxiliary Communication Port. Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable operator's terminal to control and monitor all hardware and software points associated with the controller. RS-232 communications port shall allow the operator to query and modify operating parameters of the local room terminal unit from the portable operator's terminal.
2. Digital Display temperature sensor specifications – Wired:
 - a. As called for in the sequences of operations or on the drawings, provide temperature sensors with digital displays.
 - b. The sensing element for the space temperature sensor must be IC-based and provide the following.
 - 1) Digitally communicating with the Application Specific Controller.
 - 2) Mountable to and fully covering a 2 x 4 electrical junction box without the need for an adapter wall plate.
 - 3) IC Element Accuracy: +/- 0.9°F
 - 4) Operating Range: 55 to 95°F
 - 5) Setpoint Adjustment Range: User limiting, selectable range between 55 and 95°F
 - 6) Display of temperature setpoint with numerical temperature values
 - 7) Display of temperature setpoint graphically, with a visual Hotter/Colder setpoint indication
 - 8) Calibration: Single point, field adjustable at the space sensor to +/- 5°F
 - 9) Installation: Up to 100 ft. from controller
 - 10) Auxiliary Communications Port: included
 - 11) Local OLED Temperature Display: included

- 12) Display of Temperature to one decimal place
 - 13) Temperature Setpoint Adjustment included
 - 14) Occupancy Override Function included
 - c. Auxiliary Communication Port. Each room temperature sensor shall include a terminal jack integral to the sensor assembly. The terminal jack shall be used to connect a portable operator's terminal to control and monitor all hardware and software points associated with the controller. RS-232 communications port shall allow the operator to query and modify operating parameters of the local room terminal unit from the portable operator's terminal.
3. Provide the following options as they are called for in the sequences or on the drawings:
- a. Setpoint Adjustment. The setpoint adjustment function shall allow for modification of the temperature by the building operators. Setpoint adjustment may be locked out, overridden, or limited as to time or temperature through software by an authorized operator at any central workstation, Building Controller, room sensor two-line display, or via the portable operator's terminal.
 - b. Override Switch. An override button shall initiate override of the night setback mode to normal (day) operation when activated by the occupant and enabled by building operators. The override shall be limited to two (2) hours (adjustable.) The override function may be locked out, overridden, or limited through software by an authorized operator at the operator interface, Building Controller, room sensor two-line display or via the portable operator's terminal.
 - c. Space Combination Temperature and Humidity Sensors. Each controller performing space temperature control shall be provided with a matching room temperature sensor, which also includes the ability to measure humidity for either monitoring or control purposes. The combination temperature and humidity sensors shall have the same appearance as the space temperature sensors. Humidity elements shall measure relative humidity with a +/- 2% accuracy over the range of 10 to 90% relative humidity. Humidity element shall be an IC (integrated circuit) sensing element. Humidity sensing elements shall be removable and field replaceable if needed.

B. Temperature Sensors

1. All temperature sensors shall meet the following specifications:
 - a. Accuracy: Plus or minus 0.2 percent at calibration point.
 - b. Wire: Twisted, shielded-pair cable.
 - c. Vibration and corrosion resistant
2. Space temperature sensors shall meet the following specifications:
 - a. 10k ohm type 2 thermistors
3. Insertion Elements in Ducts shall meet the following specifications:
 - a. Single point 10k ohm thermister
 - b. Use where not affected by temperature stratification

- c. The sensor shall reach more that 1/3 the distance from the duct wall
 - d. Junction box for wire splices
 - 4. Averaging Elements in Ducts shall meet the following specifications:
 - a. 72 inches (183 cm) long
 - b. Flexible
 - c. Use where prone to temperature stratification, in front of coils, or where ducts are larger than 9 sq. ft.
 - d. Junction box for wire splices
 - 5. Insertion Elements for Liquids shall meet the following specifications:
 - a. Platinum RTD with 4-20mA transmitter
 - b. Threaded mounting with matching well
 - c. Brass well with minimum insertion length of 2-1/2 inches for pipes up to 4" diameter
 - d. Brass well with insertion length of 6 inches for pipes up to 10" diameter
 - e. Junction box for wire splices
 - 6. Outside-Air Sensors Platinum RTD with 4-20mA transmitter:
 - a. Watertight enclosure, shielded from direct sunlight
 - b. Circulation fan
 - c. Watertight conduit fitting
- C. Where called for in the sequences of operations, provide the following feature on space sensors and thermostats:
 - 1. Security Sensors: Stainless-steel cover plate with insulated back and security screws
 - 2. Space sensors with setpoint adjust: Plain white plastic cover with slide potentiometer to signal a setpoint adjustment to the DDC
 - 3. Space Sensors with LCD display:
 - a. Operator buttons for adjusting setpoints, setting fans speeds and overriding unit to on/off
 - b. Graphical LCD icons for signaling heating/cooling mode, fans speed, schedule mode, actual temperature and current setpoint
- D. Equipment operation sensors as follows:
 - 1. Status Inputs for Fans: Differential-pressure switch with adjustable range of 0 to 5 inches wg.
 - 2. Status Inputs for direct drive electric motors: Current-sensing relay with current transformers, adjustable and sized for 175 percent of rated motor current.
 - 3. Status inputs for belt drive electric motors: Current sensing transmitter with linear 4-20mA output
- E. Air Differential Pressure Switches: Diaphragm type air differential pressure switches with die cast aluminum housing, adjustable setpoint, minimum 5 amp switch rating at 120VAC, SPDT switches, and the switch pressure range shall be suited for the application. Provide Dwyer or equal. These switches shall be utilized for filter status.

- F. Leak detectors: Provide spot leak detectors that can be secured to the floor or secured to a drain pan. The detection shall use a microchip controlled energized probes. The detector shall operate on 24V or less. Provide a way to adjust the height of the leak probes. The SPDT contacts shall be inside a watertight enclosure.

2.21 ELECTRO-MECHANICAL THERMOSTATS

- A. Fire-Protection Thermostats: UL listed with fixed or adjustable settings to operate at not less than 75 deg F above normal maximum operating temperature, with the following:
1. Reset: Automatic with control circuit arranged to require manual reset at central control panel, with pilot light and reset switch on panel labeled to indicate operation.
- B. Electric Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point. Setpoint shall be adjustable.
1. Bulb Length: Minimum 20 feet.
 2. Quantity: One thermostat for every 20 sq. ft. of coil surface.
- C. Electric space thermostats: Provide a charged element type stat with snap acting SPDT switch. The switch shall be rated for 16A or 1HP at 120V.

2.22 SMOKE DETECTORS

- A. Provide a smoke detector for each unit as defined in the Mechanical Drawing Schedules, M0.2. Turn it over to the mechanical contractor for installation. Wire it to stop the fan upon sensing smoke.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the architect/engineer for resolution before rough-in work is started.
- B. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started.
- C. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and the contractor's work and the plans and the work of others—the contractor shall report these discrepancies to the engineer and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others.

3.2 INSTALLATION

- A. Provide all relays, switches, sources of emergency and UPS battery back-up electricity and all other auxiliaries, accessories and connections necessary to make a complete operable system in accordance with the sequences specified. All field wiring shall be by this contractor.
- B. Install controls so that adjustments and calibrations can be readily made. Controls are to be installed by the control equipment manufacturer.
- C. Mount surface-mounted control devices on brackets to clear the final finished surface on insulation.
- D. Install equipment level and plumb.
- E. Unless otherwise noted, install wall mounted thermostats 48" above the floor measured to the top of the instrument, or as otherwise directed by the Architect.
- F. Install averaging elements in ducts and plenums in horizontal crossing or zigzag pattern.
- G. Install outdoor sensors in perforated tube and sunshield.

3.3 ELECTRICAL WIRING SCOPE

- A. This contractor shall be responsible for power that is not shown on the electrical drawings, to controls furnished by this contractor. If power circuits are shown on the electrical drawings, this contractor shall continue the power run to the control device. If power circuits are not shown, this contractor shall coordinate with the electrical contractor to provide breakers at distribution panels for power to controls. This contractor is then responsible for power from the distribution panel.
 - 1. Coordinate panel locations. If enclosures for panels are shown on the electrical drawings, furnish the enclosures according to the electrician's installation schedule.
- B. This contractor shall not be responsible for power to control panels and control devices that are furnished by others, unless it is part of the control interlock wiring.
- C. Refer to Coordination section for what devices this contractor is responsible to mount and which are turned over to others to mount.
- D. This contractor shall be responsible for wiring of any control device that is furnished as part of this section of specification.
- E. Wiring for controls furnished by others:
 - 1. Provide control wiring for HVAC controls furnished by others. Wiring may include, but not limited to, the following items:
 - a. Thermostats

- b. Manual switches for HVAC equipment (not shown on electrical drawings)
- F. Interlock wiring shall be run in separate conduits from BAS associated wiring.
- G. Provide network wiring for equipment that is called to be integrated to the BAS.

3.4 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. All low voltage control wiring shall be class 2. Control wiring that is not class 2 shall be run in separate conduits from class 2 wiring.
- B. Floor level network wiring between units can be combined with thermostat and other low voltage wiring in the same conduit. All other network wiring shall be in dedicated conduits.
- C. Install raceways, boxes, and cabinets according to Division 26 Section "Raceways and Boxes."
- D. Install building wire and cable according to Division 26 Section "Conductors and Cables."
- E. Installation shall meet the following requirements:
 - 1. Conceal cable and conduit, except in mechanical rooms and areas where other conduit and piping are exposed.
 - 2. Install exposed cable in raceway or conduit.
 - 3. Install concealed cable using plenum rated cable.
 - 4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
 - 5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
 - 6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
 - 7. All wiring in lab areas shall be in conduit.
 - 8. All unsupported risers shall be rigid steel conduit. Supported risers shall be EMT.
- F. Rigid conduit shall be steel, hot dip galvanized, threaded with couplings, $\frac{3}{4}$ inch minimum size, manufactured in accordance with ANSI C-80-1. Electrical metallic tubing (EMT) with compression fittings or intermediate metallic conduit (IMC) may be used as conduit or raceway where permitted by the NEC.
- G. Concealed control conduit and wiring shall be provided in all spaces except in the Mechanical Equipment Rooms and in unfinished spaces. Install in parallel banks with all changes in directions made at 90 degree angles.
- H. Install conduit adjacent to machine to allow service and maintenance.

- I. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- J. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.
- K. Ground equipment.

3.5 COMMUNICATION WIRING

- A. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.
- B. Do not install communication wiring in raceway and enclosures containing Class 1 wiring.
- C. Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.
- D. Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.
- E. Cable bundling:
RS485 cabling run open air in accessible areas can be bundled with other class 2 low voltage cabling.
 - 1. RS485 cabling run between terminal units in conduits above ceilings or under floors or in inaccessible areas can be bundled with other class 2 low voltage cabling.
 - 2. RS485 cabling run between floors shall be in a communication only conduit.
 - 3. RS485 conduit run long distances between utility rooms or between buildings shall be in a communication only conduit.
 - 4. Ethernet cabling shall be in a communication only conduit.
 - 5. Ethernet and RS485 can be run together.
 - 6. Fiber optics can be run with Ethernet and RS485 cabling as long as the conduit is bent to fiber optic standards and junction boxes are sized for fiber optic use.
- F. RS485 Cabling
 - 1. RS485 cabling shall be used for BACnet MS/TP networks.
 - 2. RS485 shall use low capacitance, 20-24 gauge, twisted shielded pair.
 - 3. The shields shall be tied together at each device.
 - 4. The shield shall be grounded at one end only and capped at the other end.
 - 5. Provide end of line (EOL) termination devices at each end of the RS485 network or subnetwork run, to match the impedance of the cable, 100 to 120ohm.

- G. Ethernet Cabling
 - 1. Ethernet shall not be run with any Class 1 or low voltage Class 2 wiring.
 - 2. CAT6, unshielded twisted pair (UTP) cable shall be used for BAS Ethernet.
 - 3. Solid wire shall be used for long runs, between mechanical rooms and between floors. Stranded cable can be used for patch cables and between panels in the same mechanical room up to 50 feet away.
 - 4. When the BAS Ethernet connects to an Owner's network switch, document the port number on the BAS As-builts.
- H. When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lightning arrestor shall be installed according to the manufacturer's instructions.
- I. All runs of communication wiring shall be unspliced length when that length is commercially available.
- J. All communication wiring shall be labeled to indicate origination and destination data.
- K. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

3.6 FIBER OPTIC CABLE SYSTEM:

- A. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post-installation residual cable tension shall be within cable manufacturer's specifications.
- B. All cabling and associated components shall be installed in accordance with manufacturers' instructions. Minimum cable andunjacketed fiber bend radii, as specified by cable manufacturer, shall be maintained.
- C. All terminations shall to be made into a patch panel, designed for such use. Free air terminations with patch panels are prohibited.

3.7 IDENTIFICATION

- A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the DDC system.
 - 1. Labels shall use white lettering (12-point type or larger) on a red background.
 - 2. Warning labels shall read as follows: **C A U T I O N This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing.**

- B. Permanent warning labels shall be affixed to all motor starters and all control panels that are connected to multiple power sources utilizing separate disconnects.
1. Labels shall use white lettering (12-point type or larger) on a red background.
 2. Warning labels shall read as follows: **CAUTION This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.**
- C. Control Equipment and Device labeling:
1. Labels and tags shall match the unique identifiers shown on the as-built drawings.
 2. All Enclosures shall be labeled to match the as-built drawing by either control panel name or the names of the DDC controllers inside.
 3. All sensors and actuators not in occupied areas shall be tagged.
 4. Airflow measurement arrays shall be tagged to show flow rate range for signal output range, duct size, and pitot tube AFMS flow coefficient.
 5. Duct static pressure taps shall be tagged at the location of the pressure tap.
 6. Each device inside enclosures shall be tagged.
 7. Terminal equipment need only have a tag for the unique terminal number, not for each device. Match the unique number on:
 - a. First, the design drawings, or
 - b. Second, the control as-builts, or
 - c. Third, the DDC addressing scheme
 8. Tags on the terminal units shall be displayed on the Operator Workstation Graphics.
- D. Tags shall be mechanically printed on permanent adhesive backed labeling strips, 12 point height minimum.
- E. Manufacturers' nameplates and UL or CSA labels are to be visible and legible after equipment is installed.
- F. Identification of Wires
1. Tag each wire with a common identifier on each end of the wire, such as in the control panel and at the device termination.
 2. Tag each network wire with a common identifier on each end.
 3. Tag each 120V power source with the panel and breaker number it is fed by.
- G. Identification of Conduits:
1. Identify the low voltage conduit runs as BAS conduit, power feeds not included.
 2. Identify each electric box, junction box, utility box and wiring tray with a blue paint mark or blue permanent adhesive sticker.
 3. For conduit runs that run more than 8 ft between junction boxes in 1 room, place a blue identifier at least every 8 feet.

4. Place a blue identifier on each side of where a conduit passed through a wall or other inaccessible path.
5. Identify all BAS communication conduits the same as above.

3.8 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment, and retest.
 3. Calibration test controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
- B. Engage a factory-authorized service representative to perform startup service.
- C. Replace damaged or malfunctioning controls and equipment.
 1. Start, test, and adjust control systems.
 2. Demonstrate compliance with requirements, including calibration and testing, and control sequences.
 3. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

3.9 SYSTEM CHECKOUT AND STARTUP

- A. Inspect each termination in the MER control panels and devices to make sure all wires are connected according to the wiring diagrams and all termination are tight.
- B. After the controls devices and panels are installed and power is available to the controls, perform a static checkout of all the points, including the following:
 1. Inspect the setup and reading on each temperature sensor against a thermometer to verify its accuracy.
 2. Inspect the reading of each status switch to verify the DDC reads the open and close correctly.
 3. Command each relay to open and close to verify its operation.
- C. Document that each point was verified and operating correctly. Correct each failed point before proceeding to the dynamic startup.
- D. Verify that each DDC controller communicates on its respective network correctly.
- E. After all of the points are verified, and power is available to the mechanical system, coordinate a startup of each system with the mechanical contractor. Include the following tests:

1. Start systems from DDC.
 2. Verify that each setpoint can be met by the system.
 3. Change setpoints and verify system response.
 4. Change sensor readings to verify system response.
 5. Test safety shutdowns.
 6. Verify time delays.
 7. Verify mode changes.
 8. Adjust filter switches and current switches for proper reactions.
 9. Adjust proportional bands and integration times to stabilize control loops.
- F. Perform all program changes and debugging of the system for a fully operational system.
- G. Verify that all graphics at the operator workstations correspond to the systems as installed. Verify that the points on the screens appear and react properly. Verify that all adjustable setpoints and manual commands operate from the operator workstations.
- H. After the sequence of operation is verified, setup the trends that are listed in the sequence of operations for logging and archiving for the commissioning procedure.

3.10 SYSTEM COMMISSIONING, DEMONSTRATION AND TURNOVER

- A. The BAS Contractor shall prepare and submit for approval a complete acceptance test procedure including submittal data relevant to point index, functions, sequence, inter-locks, and associated parameters, and other pertinent information for the operating system. Prior to acceptance of the BAS by the Owner and Engineer, the BAS contractor shall completely test the BAS using the approved test procedure.
- B. After the BAS contractor has completed the tests and certified the BAS is 100% complete, the Engineer shall be requested, in writing, to approve the satisfactory operation of the system, sub-systems and accessories. The BAS contractor shall submit Maintenance and Operating manuals at this time for approval. An acceptance test in the presence of the Engineer and Owner's representative shall be performed. The Owner will then shake down the system for a fixed period of time (30 days).
- C. The BAS contractor shall fix punch list items within 30 days of acceptance.
- D. When the system performance is deemed satisfactory in whole or in part by these observers, the system parts will be accepted for beneficial use and placed under warranty.

3.11 PROJECT RECORD DOCUMENTS

- A. Project Record Documents: Submit three (3) copies of record (as-built) documents upon completion of installation. Submittal shall consist of:

1. Project Record Drawings. As-built versions of the submittal shop drawings provided as AutoCAD compatible files in electronic format and as 11 x 17 inch prints.
 2. Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs used to meet requirements in the Control System Demonstration and Acceptance section of this specification.
 3. Operation and Maintenance (O & M) Manual.
 - a. As-built versions of the submittal product data.
 - b. Names, addresses, and 24-hour telephone numbers of installing contractors and service representatives for equipment and control systems.
 - c. Operator's Manual with procedures for operating control systems, logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.
 - d. Programming manual or set of manuals with description of programming language and of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
 - e. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
 - f. Documentation of all programs created using custom programming language, including setpoints, tuning parameters, and object database.
 - g. Graphic files, programs, and database on electronic media.
 - h. List of recommended spare parts with part numbers and suppliers.
 - i. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware, including computer equipment and sensors.
 - j. Complete original original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
 - k. Licenses, guarantees, and warranty documents for equipment and systems.
- B. Operating manual to serve as training and reference manual for all aspects of day-to-day operation of the system. As a minimum include the following:
1. Sequence of operation for automatic and manual operating modes for all building systems. The sequences shall cross-reference the system point names.
 2. Description of manual override operation of all control points in system.
 3. BMS system manufacturers complete operating manuals.

- C. Provide maintenance manual to serve as training and reference manual for all aspects of day-to-day maintenance and major system repairs. As a minimum include the following:
 - 1. Complete as-built installation drawings for each building system.
 - 2. Overall system electrical power supply schematic indicating source of electrical power for each system component. Indicate all battery backup provisions.
 - 3. Photographs and/or drawings showing installation details and locations of equipment.
 - 4. Routine preventive maintenance procedures, corrective diagnostics troubleshooting procedures, and calibration procedures.
 - 5. Parts list with manufacturer's catalog numbers and ordering information.
 - 6. Lists of ordinary and special tools, operating materials supplies and test equipment recommended for operation and servicing.
 - 7. Manufacturer's operation, set-up, maintenance and catalog literature for each piece of equipment.
 - 8. Maintenance and repair instructions.
 - 9. Recommended spare parts.
- D. Provide Programming Manual to serve as training and reference manual for all aspects of system programming. As a minimum include the following:
 - 1. Complete programming manuals, and reference guides.
 - 2. Details of any custom software packages and compilers supplied with system.
 - 3. Information and access required for independent programming of system.

3.12 TRAINING

- A. During System commissioning and at such time as acceptable performance of the Building Automation System hardware and software has been established, the BAS contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction during normal working hours shall be performed by a competent building automation contractor representative familiar with the Building Automation System's software, hardware and accessories.
- B. At a time mutually agreed upon, during System commissioning as stated above, the BAS contractor shall give 16-hours of onsite training on the operation of all BAS equipment. Describe its intended use with respect to the programmed functions specified. Operator orientation of the automation system shall include, but not be limited to:
 - 1. Explanation of drawings and operator's maintenance manuals.
 - 2. Walk-through of the job to locate all control components.
 - 3. Operator workstation and peripherals.
 - 4. DDC Controller and ASC operation/sequence.
 - 5. Operator control functions including scheduling, alarming, and trending.
 - 6. Explanation of adjustment, calibration and replacement procedures.
- C. Additional 8-hours of training shall be given after the 30 day shakedown period.

- D. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor. If the Owner requires such training, it will be contracted at a later date. Provide description of available local and factory customer training. Provide costs associated with performing training at an off-site classroom facility and detail what is included in the manufacturer's standard pricing such as transportation, meals, etc.

END OF SECTION 230900

NOT FOR BID

SECTION 231123 - FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
1. Natural gas piping buried
 2. Natural gas piping above grade.
 3. Unions and flanges.
 4. Valves.
 5. Gas seismic valve.
 6. Flexible connectors.
 7. Underground pipe markers.
 8. Bedding and cover materials.
- B. Related Sections:
1. Division 08 - Openings: Access doors for concealed valves and accessories.
 2. Division 09 - Finishes: Product requirements for painting for placement by this section.

1.02 REFERENCES

- C. American National Standards Institute:
1. ANSI Z21.15 - Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.
- D. American Society of Mechanical Engineers:
1. ASME B16.33 - Manually Operated Metallic Gas Valves for Use in Gas Piping Systems Up to 125 psig (sizes 1/2 - 2).
 2. ASME B31.9 - Building Services Piping.
- E. ASTM International:
1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
 3. ASTM D2513 - Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings.
 4. ASTM D2683 - Standard Specification for Socket Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing
 5. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
- F. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.
- G. American Water Works Association:
 1. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
- H. Manufacturers Standardization Society of the Valve and Fittings Industry:
 1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
 2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
 3. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
 4. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- I. National Fire Protection Association:
 1. NFPA 54 - National Fuel Gas Code.
- J. Underwriters Laboratories Inc.:
 1. UL 842 - Valves for Flammable Fluids.

1.03 SYSTEM DESCRIPTION

- K. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.
- L. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves, equipment.
- M. Provide pipe hangers and supports in accordance with ASME B31.9, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89.
- N. Use ball or gas cocks valves for shut-off and to isolate equipment, part of systems, or vertical risers.

1.04 SUBMITTALS

- O. Division 01 – General Requirements: Submittal procedures.
- P. Product Data:
 1. Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information.
 2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
 3. Hangers and Supports: Submit manufacturers catalog information including load capacity.

4. Piping Specialties: Submit manufacturers catalog information including capacity, rough-in requirements, and service sizes for the following:
- a. Natural gas pressure regulators.

- Q. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- R. Test Reports: Indicate results of piping system pressure test.
- S. Manufacturer's Certificate: Certify Products meet or exceed specified requirements
- T. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.05 CLOSEOUT SUBMITTALS

- U. Division 01 – General Requirements: Closeout procedures.
- V. Project Record Documents: Record actual locations of valves, piping system, and system components.
- W. Operation and Maintenance Data: Submit for valves and gas pressure regulators installation instructions, spare parts lists.

1.06 QUALITY ASSURANCE

- X. Perform natural gas Work in accordance with NFPA 54.
- Y. Perform work in accordance with CPC.
- Z. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.
- AA. Perform Work in accordance with applicable code AWS D1.1 for welding hanger and support attachments to building structure.
- BB. Furnish shutoff valves complying with ASME B16.33 or ANSI Z21.15.
- CC. Maintain one copy of each document on site.

1.07 QUALIFICATIONS

- DD. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

- EE. Installer: Company specializing in performing Work of this section with minimum five years documented experience.
- FF. Design hangers and supports under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of California.

1.08 PRE-INSTALLATION MEETINGS

- GG. Division 01 – General Requirements: Pre-installation meeting.
- HH. Convene minimum one week prior to commencing work of this section.

1.09 DELIVERY, STORAGE, AND HANDLING

- II. Division 01 – General Requirements: Product storage and handling requirements.
- JJ. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- KK. Protect piping and fittings from soil and debris with temporary end caps and closures. Maintain in place until installation. Furnish temporary protective coating on cast iron and steel valves.

1.10 ENVIRONMENTAL REQUIREMENTS

- LL. Division 01 – General Requirements.
- MM. Do not install underground piping when bedding is wet or frozen.

1.11 FIELD MEASUREMENTS

- NN. Verify field measurements prior to fabrication.

1.12 COORDINATION

- OO. Division 01 – General Requirements: Requirements for coordination.
- PP. Coordinate trenching, excavating, bedding and backfilling of buried piping systems.

1.13 WARRANTY

- QQ. Division 01 – General Requirements: Product warranties and product bonds.
- RR. Furnish five year manufacturer warranty for valves excluding packing.

1.14 EXTRA MATERIALS

SS. Division 01 – General Requirements: Spare parts and maintenance products.

TT. Furnish two packing kits for each type and size valve.

PART 2 PRODUCTS

2.01 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

- UU. Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Fittings: ASTM A234/A234M forged steel welding type.
 2. Joints: ASME B31.9, welded.
 3. Jacket: AWWA C105 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.
 4. High density polyethylene pipe and fittings in accordance with ASTM D-2513, Grades 2306, 3306, and 3408 with fusion joints only, similar to Driscopipe 8100-DRII Series.

2.02 NATURAL GAS PIPING, BURIED BEYOND 5 FEET OF BUILDING

- VV. Polyethylene Pipe: ASTM D2513, SDR 11.5. Fittings: ASTM D2683 or ASTM D2513 socket type. Joints: Fusion welded; plastic to steel connections with ASTM D2513 transition fittings or risers. Pipe shall be buried 30 inches deep and backfill with sand, including identification tape and #14 insulated copper tracer wire.
- WW. Transition riser from below grade polyethylene pipe to above grade steel pipe; ASTM D2513, Schedule 40 steel epoxy coated casing welded or threaded end, the polyethylene end shall be fusion welded, as manufactured by "Central" or equal.

2.03 NATURAL GAS PIPING, ABOVE GRADE

- XX. Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M forged steel welding type.
 2. Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

2.04 UNIONS AND FLANGES

- YY. Unions for Pipe 2 inches and Smaller:
1. Ferrous Piping: Class 150, malleable iron, threaded.
 2. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

- ZZ. Flanges for Pipe 2-1/2 inches and Larger:
1. Ferrous Piping: Class 150, forged steel, slip-on flanges.
 2. Copper Piping: Class 150, slip-on bronze flanges.
 3. Gaskets: 1/16 inch thick preformed neoprene gaskets.

2.05 GAS BALL VALVES

- AAA. Above and Below Grade 1/4 inch to 2 inch: Two piece, threaded ends, brass body, chrome plated brass ball, reinforced teflon seats, blow-out proof stem, CSA certified, full port, similar to Jomar Model No. 175-LWN.
- BBB. Above Grade 1-1/4 inch to 4 inch: MSS SP 110, Class 125, two piece, threaded ends, brass body, chrome plated brass ball, reinforced teflon seats, blow-out proof stem, lever handle, CSA certified, full port, similar to Apollo Model No. 94A.

2.06 GAS COCKS

- CCC. Indoor Up to 2 Inches: Bronze body, bronze tapered plug, lubricated, Teflon packing, threaded ends, CSA certified.
- DDD. Over 2 Inches: Cast iron body and plug, lubricated, Teflon packing, flanged ends, CSA certified.
- EEE. Similar to McDonald Model No. 10596.

2.07 GAS SEISMIC VALVES

- FFF. Provide a valve consisting of a swing check valve arrangement with an acceleration-sensitive triggering mechanism. The trip mechanism shall consist of a steel ball resting on a tapered cup-shaped support. The trip mechanism shall be factory set and sealed. A sight glass is provided so that the Open or Closed indicator can be seen, and the trip mechanism status of the valve can be easily determined. The valve assembly shall be certified by the California State Architect's Office, approved by the local authority, meet the requirements of ANSI Z21.70 and ASCE 25-97. See Schedule for Model number.

2.08 FLEXIBLE CONNECTORS

- GGG. Coated stainless steel, fittings suitable for connection to piping system and equipment, capacity sufficient for the application, CSA Certified. Similar to Dormont Model No. 10.

PART 3 EXECUTION

3.01 EXAMINATION

- HHH. Division 01 – General Requirements: Coordination and project conditions.

III. Verify excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

JJJ. Ream pipe and tube ends. Remove burrs.

KKK. Remove scale and dirt, on inside and outside, before assembly.

LLL. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION - INSERTS

MMM. Provide inserts for placement in concrete forms.

NNN. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

OOO. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

PPP. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

QQQ. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

3.04 INSTALLATION - PIPE HANGERS AND SUPPORTS

RRR. Install hangers and supports in accordance with ASME B31.9, ASTM F708, and MSS SP 89.

SSS. Support horizontal piping hangers as scheduled.

TTT. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

UUU. Place hangers within 12 inches of each horizontal elbow.

VVV. Install hangers to allow 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

WWW. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

XXX. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.

YYY. Prime coat exposed steel hangers and supports in accordance with Section 099000. Finish paint exposed steel hangers and supports in accordance with Section 099000. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

ZZZ. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

3.05 INSTALLATION - BURIED PIPING SYSTEMS

AAAA. Install natural gas piping in accordance with NFPA 54.

BBBB. Verify connection to existing piping system size, location, and invert are as indicated on Drawings.

CCCC. Establish elevations of buried piping with not less than that indicated on the drawings.

DDDD. Establish minimum separation of 1 foot from other services piping in accordance with CPC code.

EEEE. Remove scale and dirt on inside of piping before assembly.

FFFF. Excavate pipe trench in accordance with Division 31.

GGGG. Install pipe to elevation as indicated on Drawings.

HHHH. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding 6 inches compacted depth; compact to 95 percent maximum density.

IIII. Install pipe on prepared bedding.

JJJJ. Route pipe in straight line.

KKKK. Install pipe to allow for expansion and contraction without stressing pipe or joints.

LLLL. Install trace wire continuous over top of pipe, buried 6 inches below pipe line.

MMMM. Pipe Cover and Backfilling:

1. Maintain optimum moisture content of fill material to attain required compaction density.
2. After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in 6 inches compacted layers to 12 inches minimum cover over top of jacket. Compact to 95 percent maximum density.

3. Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.
4. Do not use wheeled or tracked vehicles for tamping.

3.06 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

NNNN. Install natural gas piping in accordance with NFPA 54.

OOOO. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

PPPP. Route piping in orderly manner and maintain gradient.

QQQQ. Where required, bend pipe with pipe bending tools in accordance with procedures intended for that purpose.

RRRR. Install piping to conserve building space and not interfere with use of space.

SSSS. Size and install gas piping to provide sufficient gas to supply maximum appliance demand at pressure higher than appliance minimum inlet pressure.

TTTT. Group piping whenever practical at common elevations.

UUUU. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

VVVV. Sleeve pipe passing through partitions, walls and floors. Refer to Section 230529.

WWWW. Provide clearance for installation of insulation and access to valves and fittings.

XXXX. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Division 08.

YYYY. Where pipe support members are welded to structural building framing, scrape, brush clean, weld, and apply one coat of zinc rich primer. Refer to Division 05.

ZZZZ. Provide support for utility meters in accordance with requirements of utility company.

AAAAA. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting. Refer to Division 09.

BBBBB. Install identification on piping systems including underground piping. Refer to Section 230553.

CCCCC. Install valves with stems upright or horizontal, not inverted.

DDDDD. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

3.07 FIELD QUALITY CONTROL

EEEEEE. Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.

FFFFF. Where gas appliance will be damaged by test pressure, disconnect appliance and cap piping during pressure test. Reconnect appliance after pressure test and leak test connection.

GGGGG. Where gas appliance is designed for operating pressures equal to or greater than piping test pressure, provide gas valve to isolate appliance or equipment from gas test pressure.

HHHHH. Pressure test natural gas piping in accordance with NFPA 54.

IIIII. Where new branch piping is extended from existing system, pressure test new branch piping only. Leak test joint between new and existing piping with noncorrosive leak detection fluid or other approved method.

JJJJJ. When pressure tests do not meet specified requirements, remove defective work, replace and retest.

KKKKK. Immediately after gas is applied to a new system, or a system has been restored after gas service interruption, check pipe for leakage.

1. Where leakage is detected, shut off gas supply until necessary repairs are complete.

LLLLL. Do not place appliances in service until leak testing and repairs are complete.

3.08 SCHEDULES

MMMMM. Pipe Hanger Spacing:

PIPE SIZE Inches	COPPER TUBING MAXIMUM HANGER SPACING Feet	STEEL PIPE MAXIMUM HANGER SPACING Feet	COPPER TUBING MINIMUM HANGER ROD DIAMETER Inches	STEEL PIPE MINIMUM HANGER ROD DIAMETER Inches
1/2	4	6	3/8	3/8
3/4	6	7	3/8	3/8

1	6	7	3/8	3/8
1-1/4	8	7	3/8	3/8
1-1/2	8	9	3/8	3/8
2	8	10	3/8	3/8
2-1/2	8	10	1/2	1/2
3	8	10	1/2	1/2
4	8	10	1/2	5/8
5	8	10	1/2	5/8
6	8	10	5/8	3/4
8	8	10	3/4	3/4

END OF SECTION 231123

NOT FOR BID

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Refrigerant piping.
 2. Unions, flanges, and couplings.
 3. Pipe hangers and supports.
 4. Refrigerant moisture and liquid indicators.
 5. Valves.
 6. Refrigerant filter-driers.
 7. Refrigerant expansion valves.
 8. Electronic expansion valves.
- B. Related Sections:
1. Division 05 - Metals: Product requirements for touch-up painting of steel joists.
 2. Division 07 - Thermal and Moisture Protection: Product requirements for firestopping for placement by this section.
 3. Division 08 - Openings: Access doors for concealed valves and accessories.
 4. Division 09 - Finishes: Product requirements for painting for placement by this section.
 5. Section 230529 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports, sleeves, [and firestopping] for placement by this section.
 6. Section 230548 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for Vibration Isolation for placement by this section.
 7. Section 230553 - Identification for HVAC Piping and Equipment: Product requirements for pipe identification for placement by this section.
 8. Section 230700 - HVAC Insulation: Product requirements for Piping Insulation for placement by this section.
 9. Section 260503 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

- A. Air-Conditioning and Refrigeration Institute:
1. ARI 495 - Refrigerant Liquid Receivers.
 2. ARI 710 - Liquid-Line Driers.
 3. ARI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter Dryers.
 4. ARI 750 - Thermostatic Refrigerant Expansion Valves.

- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 15 - Safety Code for Mechanical Refrigeration.
- C. American Society of Mechanical Engineers:
 - 1. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - 2. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
 - 3. ASME B31.5 - Refrigeration Piping.
 - 4. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
- D. ASTM International:
 - 1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
 - 3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
 - 4. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
 - 5. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
- E. American Welding Society:
 - 1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
 - 2. AWS D1.1 - Structural Welding Code - Steel.
- F. Manufacturers Standardization Society of the Valve and Fittings Industry:
 - 1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
 - 2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
 - 3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.3 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.
- B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves or equipment.
- C. Provide pipe hangers and supports in accordance with ASME B31.5.
- D. Flexible Connectors: Use at or near compressors where piping configuration does not absorb vibration.

1.4 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Shop Drawings: Indicate layout of refrigeration piping system, including equipment, critical dimensions, and sizes.
- C. Product Data:
 - 1. Piping: Submit data on pipe materials, fittings, and accessories.
 - 2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.
 - 3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
 - 4. Refrigerant Specialties: Submit manufacturers catalog information including capacity, component sizes, rough-in requirements, and service sizes for the following:
 - a. Refrigerant moisture and liquid indicators.
 - b. Refrigerant strainers.
 - c. Refrigerant filter-driers.
 - d. Refrigerant expansion valves.
 - e. Electronic expansion valves.
- D. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- E. Test Reports: Indicate results of piping system pressure test.
- F. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures and isolation.
- G. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of valves, equipment and refrigerant accessories.
- C. Operation and Maintenance Data: Submit instructions for installation and changing components, spare parts lists, exploded assembly views.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with ASME B31.5 code for installation of refrigerant piping systems.

- B. Perform Work in accordance with applicable code and authority having jurisdiction for welding hanger and support attachments to building structure.
- C. Maintain one copy of document on site.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Fabricator or Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.8 PRE-INSTALLATION MEETINGS

- A. Division 01 – General Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Product storage and handling requirements.
- B. Dehydrate and charge refrigeration components including piping and receivers, seal prior to shipment. Maintain seal until connected into system.
- C. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 – General Requirements.

1.11 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.12 COORDINATION

- A. Division 01 – General Requirements: Requirements for coordination.

1.13 WARRANTY

- A. Division 01 – General Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for valves excluding packing.

1.14 MAINTENANCE MATERIALS

- A. Division 01 – General Requirements: Spare parts and maintenance products.

1.15 EXTRA MATERIALS

- A. Division 01 – General Requirements: Spare parts and maintenance products.
- B. Furnish two packing kits for each size and valve type.
- C. Furnish two refrigerant filter-dryer cartridges of each type.

PART 2 - PRODUCTS

2.1 REFRIGERANT PIPING

- A. Copper Tubing: ASTM B280, drawn.
 - 1. Fittings: ASME B16.22 wrought copper.
 - 2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.2 UNIONS, FLANGES, AND COUPLINGS

- A. 2 inches and Smaller:
 - 1. Ferrous Piping: 150 psig malleable iron, threaded.
 - 2. Copper Pipe: Bronze, soldered joints.
- B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.3 PIPE HANGERS AND SUPPORTS

- A. See Specification Section 230529. Manufacturers:

2.4 REFRIGERANT MOISTURE AND LIQUID INDICATORS

- A. Manufacturers:
 - 1. Alco Controls Div, Emerson Electric Co.
 - 2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
 - 3. Sporlan Valve Co.
 - 4. Substitutions: Section 016100 - Product Requirements.

- B. Indicators:
1. Port: Single, UL listed.
 2. Body: Copper or brass, flared or solder ends.
 3. Sight glass: Color-coded paper moisture indicator with removable element cartridge and plastic cap.
 4. Maximum working pressure: 500 psig
 5. Maximum working temperature: 200 degrees F.

2.5 VALVES

- A. Manufacturers:
1. Alco Controls Div, Emerson Electric Co.
 2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
 3. Sporlan Valve Co.
 4. Substitutions: Section 016100 - Product Requirements.
- B. Diaphragm Packless Valves:
1. UL listed, globe or angle pattern, forged brass body and bonnet solder or flared ends.
 2. Phosphor bronze and stainless steel diaphragms, rising stem and hand wheel.
 3. Stainless steel spring, nylon seats, disc with positive back seating.
 4. Maximum working pressure: 500 psig.
 5. Maximum working temperature: 275 degrees F.
- C. Packed Angle Valves:
1. Forged brass, solder or flared ends.
 2. Forged brass seal caps with copper gasket, rising stem and seat [with back seating], molded stem packing.
 3. Maximum working pressure: 500 psig.
 4. Maximum working temperature: 275 degrees F.
- D. Ball Valves:
1. Two piece forged brass body with teflon ball seals and copper tube extensions, brass seal cap, chrome plated ball, stem with neoprene ring stem seals, soldered or threaded ends.
 2. Maximum working pressure: 500 psig.
 3. Maximum working temperature: 325 degrees F.
- E. Service Valves:
1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends.
 2. Maximum working pressure: 500 psig.

2.6 REFRIGERANT FILTER-DRIERS

- A. Manufacturers:
1. Alco Controls Div, Emerson Electric Co.

2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
 3. Sporlan Valve Co.
 4. Substitutions: Section 016100 - Product Requirements.
- B. Replaceable Cartridge Angle Type:
1. Shell: ARI 710, UL listed, steel, removable cap, for maximum working pressure of 500 psig, inches outside diameter size connections.
 2. Filter Cartridge: Pleated media with integral end rings, stainless steel support.
 3. Filter/Dryer Cartridge: Pleated media with solid core sieve with activated alumina.
 4. Wax Removal Cartridge: Molded bonded core of activated charcoal with integral gaskets.
- C. Permanent Straight Through Type:
1. ARI 710, UL listed, steel shell with molded desiccant filter core, for maximum working pressure of 500 psig.

2.7 REFRIGERANT EXPANSION VALVES

- A. Manufacturers:
1. Alco Controls Div, Emerson Electric Co.
 2. Parker Hannifin Corp., Refrig. & Air Cond. Div.
 3. Sporlan Valve Co.
 4. Substitutions: Section 016100 - Product Requirements..
- B. Angle or Straight Through Type: ARI 750; design suitable for refrigerant, brass body, internal or external equalizer, mechanical pressure limit (maximum operating pressure MOP feature), adjustable superheat setting, replaceable inlet strainer, with replaceable capillary tube and remote sensing bulb.
- C. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F superheat. Select to avoid being undersized at full load and oversized at part load.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Coordination and project conditions.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.

- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- E. Structure and other equipment for installation of insulation and access to valves and fittings.

3.3 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

- A. Route piping parallel to building structure and maintain gradient.
- B. Install piping to conserve building space, and not interfere with use of space.
- C. Group piping whenever practical at common elevations.
- D. Sleeve pipe passing through partitions, walls and floors. Refer to Section 230529.
- E. Install pipe identification in accordance with Section 230553.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Division 08.
- H. Arrange refrigerant piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
- I. Flood refrigerant piping system with nitrogen when brazing.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds. Refer to Section.
- K. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Division 09.
- L. Install valves with stems upright or horizontal, not inverted.
- M. Insulate piping and equipment; refer to Section 230700.
- N. Provide replaceable cartridge filter-dryers, with isolation valves and bypass with valve.
- O. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

- P. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.
- Q. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.
- R. Fully charge completed system with refrigerant after testing.
- S. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.
- T. Install refrigerant piping in accordance with ASME B31.5.

3.4 INSTALLATION - REFRIGERANT SPECIALTIES

- A. Refrigerant Liquid Indicators:
 - 1. Install line size liquid indicators in main liquid line downstream of condenser.
 - 2. When receiver is provided, install line size liquid indicators in liquid line downstream of receiver.
 - 3. Install line size liquid indicators downstream of liquid solenoid valves.
- B. Refrigerant Valves:
 - 1. Install service valves on compressor suction and discharge.
 - 2. Install gage taps at compressor inlet and outlet.
 - 3. Install gage taps at hot gas bypass regulators, inlet and outlet.
 - 4. Install check valves on compressor discharge.
 - 5. Install check valves on condenser liquid lines on multiple condenser systems.
 - 6. Install refrigerant charging valve in liquid line between receiver shut-off valve and expansion valve.
- C. Filter-Dryers:
 - 1. Install permanent filter-dryers in low temperature systems.
 - 2. Install permanent filter-dryer in systems containing hermetic compressors.
 - 3. Install replaceable cartridge filter-dryer vertically in liquid line adjacent to receivers.
 - 4. Install replaceable cartridge filter-dryer upstream of each solenoid valve.

3.5 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Test refrigeration system in accordance with ASME B31.5.
- C. Pressure test refrigeration system with dry nitrogen to 200 psig. Perform final tests at 27 inches vacuum and 200 psig using electronic leak detector.

- D. Repair leaks.
- E. Retest until no leaks are detected.

3.6 SCHEDULES

A. Pipe Hanger Spacing:

PIPE SIZE Inches	COPPER TUBING MAXIMUM HANGER SPACING Feet	MINIMUM HANGER ROD DIAMETER COPPER TUBING Inches	MINIMUM HANGER ROD DIAMETER STEEL PIPE Inches
1/2	5	3/8	3/8
3/4	5	3/8	3/8
1	6	3/8	3/8

END OF SECTION 232300

SECTION 23 31 00 - HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Duct Materials.
 - 2. Insulated flexible ducts.
 - 3. Single wall spiral round ducts.
 - 4. Transverse duct connection system.
 - 5. Ductwork fabrication.
 - 6. Kitchen hood ductwork fabrication.
 - 7. Duct cleaning.
- B. Related Sections:
 - 1. Division 09 - Painting and Coating: Execution requirements for Weld priming, weather resistant, paint or coating specified by this section.
 - 2. Division 23 - Hangers and Supports for HVAC and Plumbing Piping and Equipment: Product requirements for hangers, supports and sleeves for placement by this section.
 - 3. Division 23 - Air Duct Accessories: Product requirements for duct accessories for placement by this section.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 - 2. ASTM A90/A90M - Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
 - 3. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - 4. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
 - 5. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 6. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 7. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 - 8. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

9. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
 10. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
 11. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. California Mechanical Code:
1. CMC – State of California Mechanical Code.
- C. National Fire Protection Association:
1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
 2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
- D. Sheet Metal and Air Conditioning Contractors:
1. SMACNA - HVAC Air Duct Leakage Test Manual.
 2. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- E. Underwriters Laboratories Inc.:
1. UL 181 - Factory-Made Air Ducts and Connectors.

1.3 PERFORMANCE REQUIREMENTS

- A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts, if it is not shown on the drawings.

1.4 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Submit duct fabrication drawings, drawn to scale not smaller than 1/4 inch equals 1 foot, on drawing sheets same size as Contract Documents, indicating:
1. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other work.
 2. Duct layout, indicating pressure classifications and sizes in plan view. For exhaust duct systems, indicate classification of materials handled as defined in this section.
 3. Fittings.
 4. Reinforcing details and spacing.
 5. Seam and joint construction details.
 6. Penetrations through fire rated and other walls.
 7. Terminal unit, and coil installations.

8. Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.
9. Equipment service clearance, access panels and door swings.
- C. Product Data: Submit data for duct materials, duct liner and duct connectors.
- D. Acceptance or no exceptions taken by the engineer on any substitution proposed by the contractor shall not be construed as relieving the contractor from compliance with the project's specifications and performance requirements nor departure there from. The contractor remains responsible for details and accuracy for confirming and correlating quantities and dimensions and for the selection of fabrication processes, techniques and assembly, coordination of his work with that of all other trades and making any needed modifications consequent to the substitution at his own cost and for performing the work in a safe manner.

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.
- B. Construct ductwork to NFPA 90A standards.
- C. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum three weeks prior to commencing work of this section.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - Product Requirements.
- B. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.
- C. Maintain temperatures during and after installation of duct sealant.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.11 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Product warranties and product bonds.

PART 2 - PRODUCTS

2.1 DUCT MATERIALS

- A. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G90 zinc coating of in conformance with ASTM A90/A90M.
- B. Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14, aluminum connectors and Bar Stock: alloy 6061-T6 or of equivalent strength.
- C. Stainless Steel Ducts: ASTM A240/A240M or ASTM A666, Type 304.
- D. Fasteners: Rivets, bolts, or sheet metal screws.
- E. Steel shapes shall be hot rolled, galvanized.
- F. Screws and bolts shall be cadmium plated.
- G. Materials and fabrication shall comply with 2013 California Mechanical Code.
- H. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 INSULATED FLEXIBLE DUCTS

- A. Manufacturers:
 - 1. Casco
 - 2. Thermflex
 - 3. Glen Flex
 - 4. Substitutions: Division 01 - Product Requirements.

- B. Product Description: Flexible duct shall consist of an exterior reinforced laminated vapor barrier, 1-1/2 inch thick fiberglass insulation ($K = .25 @ 75$ degrees F), encapsulated spring steel wire helix and impervious, smooth, non-perforated interior vinyl liner. Individual lengths of flexible ducts shall contain factory fabricated steel connection collars. Flexible fiberglass duct shall meet the requirements of NFPA No. 90A and UL 181.
1. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
 2. Maximum Velocity: 4000 fpm.
 3. Temperature Range: -10 degrees F to 160 degrees F.
 4. Furnish each flexible duct section with integral clamping devices for connection to round or oval fittings.
 5. Join each flexible duct section to main trunk duct through sheet metal fittings. Construct fittings of galvanized steel and equip with factory installed volume damper having positive locking regulator. Provide fittings installed in lined ductwork with insulation guard.
 6. Flexible ducts shall be supported at or near mid-length with 2 inch wide, 28 gage steel hanger collar, attached to the structure with an approved duct hanger. Installation shall minimize sharp radius turns or offsets. The maximum length connecting to terminal outlets shall be 7 feet and minimum length of 5 feet.
 7. Insulated flexible ducts shall be continuous, single pieces, 7' in length for low pressure, and they shall be adequately supported with a center strap support. Ducts shall be installed with a minimum radius of bend of two duct diameters. These flexible ducts are specified to tie into side inlet/outlet insulated ceiling diffusers or return air grills. The metal duct system shall be installed such that sufficient room exists to accommodate the flex duct straight runs from the metal duct to the ceiling devices. Distances too close to meet the intent of the specifications will be revised and installed according to the specifications.
 8. Low pressure ductwork shall have precut lengths with continuous inner liner, factory installed female collars and fastening devices at each end, a factory installed manual balancing damper assembly complete with a level position indicator and a positive locking device.
 9. Provide all round duct takeoffs from low pressure ducts with aluminum draw band, or Spin-In Twist-Lok fittings, approved for installation in return air plenum.
- C. UL Requirements:
1. The entire flexible duct assembly shall be labeled in accordance with UL-181 Class I air duct requirements and not have a flame and smoke spread rating in excess of 25/50.
 2. Installation must conform with factory supplied and UL approved print installation instruction sheets.
 3. Submittals will be required to include product data sheets and installation instruction sheets in order to assure awareness of the proper installation technique.

2.3 SINGLE WALL SPIRAL ROUND DUCTS

- A. Manufacturers:
1. McGill Airflow Corporation
 2. Semco Incorporated
 3. Tangent Air Corp
 4. Spiral Mfg. Co., Inc.
 5. Substitutions: Division 01 - Product Requirements.
- B. Product Description: UL 181, Class 1, round spiral lock seam duct constructed of galvanized steel.

- C. Construct duct with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	26
15 inches to 26 inches	24
28 inches to 36 inches	22
38 inches to 50 inches	20
52 inches to 84 inches	18

- D. Construct fittings with the following minimum gages:

Diameter	Gauge
3 inches to 14 inches	24
15 inches to 26 inches	22
28 inches to 36 inches	20
38 inches to 50 inches	20
52 inches to 60 inches	18
62 inches to 84 inches	16

2.4 RECTANGULAR DUCT FABRICATION (GENERAL)

- A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals except as modified by this specification.
1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
 2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

- B. Elbows shall be radius or short radius with vanes, type RE 1 and RE 3 in the SMACNA manual. Mitered elbows with turning vanes shall be used where shown on drawings. Construct vanes per pages A.41 and A.43 of the SMACNA manual.
- C. Divided flow branches shall be per SMACNA manual figure 2-5, type 1 or type 4A or 4B only.
- D. Branch connections per SMACNA manual figure 2-6; 45-degree entry shall only be used where airflow in branch is less than 25% of total airflow in main duct.
- E. Offsets shall be SMACNA manual figure 2-7, type 3 only.
- F. Bell-mouth transitions shall be used on connections to air handling units and plenums.
- G. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
 - 1. Manufacturers:
 - a. TDC.
 - b. Ductmate Industries, Inc.
 - c. Nexus Inc.
- H. Longitudinal Seams: Pittsburgh lock sealed with non-curing polymer sealant. Button punch snap lock seams are not acceptable to the University and shall not be used.
- I. Provide drive slip or equivalent flat seams for ducts exposed in the conditioned space or where necessary due to space limitations.
- J. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sf of non-braced panel area unless ducts are lined.

2.5 RECTANGULAR DUCTWORK FABRICATION (INTERIOR)

- A. Low Pressure Duct Construction Schedule: (2 inch" S.P. and below). Include all return, exhaust, supply branches and ductwork downstream of terminal units.

Duct Dimension (Inches)	Material Gauges	Construction of Transverse Joints, Bracing and Reinforcing
0 to 12	26	Hemmed S slip spaced not more than 10' apart
13 to 30	24	Ductmate Jr.** or 1" G lock spaced not more than 10' apart
31 to 42	22	Ductmate Jr.** spaced not more than 5' apart
43 to 54	22	Ductmate**, spaced not more than 4' apart
55 to 60	20	Ductmate**, spaced not more than 4' apart
61 to 84	20	Ductmate**, spaced not more than 4' apart
85 and up	18	Ductmate**, spaced not more than 4' apart. Provide intermediate bracing for low pressure ductwork 85" and larger

Note: * Based on maximum of 2.0" WG.
** The Lockformer Company TDC or approved equal

1. Provide intermediate bracing for low pressure ductwork 85 inches and larger.
 2. All ducts over 18 inches in either dimension shall be stiffened with beads on 24 through 20 gage. Cross break on 18 and 16 gage. Longitudinal seams shall be Pittsburgh locks Snap-Lock shall be limited to 12 inch maximum width of ducts.
- B. Strap hanger shall be a minimum of 1 inch, #18 gauge galvanized steel attached to the bottom of ducts at 8'- 0" OC and as required by CMC and SMACNA guidelines.
- C. Elbows shall be radius or short radius with vanes, type RE 1 and RE 3 in the SMACNA manual. Mitered elbows with turning vanes shall be used where shown on drawings. Construct vanes per pages A.41 and A.43 of the SMACNA manual.
- D. Divided flow branches shall be per SMACNA manual figure 2-5, type 1 or type 4A or 4B only.
- E. Branch connections per SMACNA manual figure 2-6; 45-degree entry shall only be used where airflow in branch is less than 25% of total airflow in main duct.
- F. Offsets shall be SMACNA manual figure 2-7, type 3 only.
- G. Bellmouth transitions shall be used on connections to air handling units and plenums.
- H. Provide Ductmate and Ductmate, Jr. with all required material including metal cleats, corner bolts and nuts, angles, clips and gaskets, all installed in accordance with manufacturer's recommendations and supervision.
- I. Quadrant volume damper blades in fittings shall be two gauges heavier than the fittings.
- J. Longitudinal Seams: Pittsburgh lock sealed with non-curing polymer sealant. Button punch snap lock seams are not acceptable and shall not be used.
- K. Provide drive slip or equivalent flat seams for ducts exposed in the conditioned space or where necessary due to space limitations.
- L. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of non-braced panel area unless ducts are lined.

- M. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- N. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.

2.6 ROUND DUCT AND FITTING FABRICATION (INTERIOR)

- A. Circular (across section) ducts shall be galvanized steel of spiral seam construction, fittings shall have continuous, welded, stamped construction both manufactured by United Sheet Metal, Omniduct, Spiromatic, Spiro Duct, Casco or approved equal.
- B. Make joints between two ducts with beaded sleeve joint, with duct sealer applied to both the male and female duct ends, then mechanically fastened with sheet metal screws.
- C. Install all duct work according to the following: the radius of elbows shall be minimum of 1 1/2 times diameter or maximum width of duct. Gored ells are not acceptable. Violations of this requirement shall be removed from the system and replaced per the design documents and the drawings at no cost to the Owner. Failure to do so will result in the Project Manager replacing the defective installation and back charging the cost to the offending contractor.
- D. Tee fittings shall be of conical type changing in shape from round to rectangular with transformation joint with minimum of 1 to 7 taper.
- E. Corrugated or flexible metal duct, or shop fabricated circular ducts will not be acceptable.

2.7 DUCT 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.
- B. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
- C. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 181 listed; passes UL 723 for flame spread and smoke development; and complying with NFPA requirements for Class 1 ducts.
- D. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

- E. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.
- F. Provide sealant or tape for metal ducts at duct joints which are defined as transverse joints between duct sections including girth joints, branch and sub-branch intersections, duct collar tap-ins, fitting subsections, louver and air terminal connections, access doors and frames, and abutments to building structure. Also provide the same at duct seams which are defined as longitudinal joint between duct sections. Spiral lock seams in factory fabricated round or oval ducts are excluded.
- G. Sealant for low-pressure ducts shall be: Design Polymerics- DP1010 or 1020, Childers Chil-Flex CP145A/146, Foster's Duct-Fas 32-19, Kingco-Glenkote11-500, Ductmate ProSeal or FiberSeal, or equal. Provide tape joints with canvas fastened with Borden Chemical Division Arabol adhesive, or equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION

- A. Install ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, as required in this section and in the Contract Drawings.
- B. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- C. Use beaded sleeve couplings for joining round duct and flexible ducts.
- D. Install duct hangers and supports in accordance with details on drawings.
- E. Use double nuts and lock washers on threaded rod supports.
- F. Seal all ductwork.

3.3 INSTALLATION OF METAL DUCTWORK

- A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (5% leakage for systems rated 3 inch and under; 1% for systems rated over 3 inch) and noiseless (no objectionable noise) systems capable of performing each indicated service. Install each run with a minimum number of joints.

Align ductwork accurately at connections, within 1/8 inch misalignment tolerance and

with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor.

- B. Field Fabrication: Complete fabrication of work at project as necessary to match shop fabricated work and accommodate installation requirements.
- C. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, column, and other structural and permanent enclosure elements of building. Limit clearance to 1/2 inch where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1 inch clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.
- D. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
- E. Tape the clips, Snaplock seams and joints or connections of the metal supply, return and exhaust ducts and the grilled and diffuser connections with 4 inch strips of 6 oz. canvas attached with Arabol or Hardcast adhesive. Tape the filter frames the same as ducts. Coat all canvas exposed to the weather with Tuff Bond #12. Taping of Pittsburgh seams is required. Exposed interior ductwork intended for open ceilings shall not be taped or covered with canvas.
- F. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.
- G. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.
- H. Round ducts shall be used to the maximum extent possible. As duct size increases, flat oval shall be considered. Rectangular ducts shall be limited to areas of space restriction with a maximum aspect ratio of 2:1. If due to a structural clearance constraint, duct aspect ratio can be increased and/or duct cross section reduced if upstream transition has included angles of 60 degrees or less and downstream transition has included angles of 30 degrees or less.
- I. Ducts exposed outside to elements shall only be of round construction to shed rainwater. If conditions do not allow round ducts, provisions shall be provided to

slope the flat top of rectangular ductwork so rainwater will not stand on top of duct.

- J. Except for connection of terminal discharge duct to air outlets, 90 degree taps shall not be used unless space prohibits the use of low loss fittings. Takeoff feeding terminals shall be conical branch; 45 wye, conical branch; low loss tee; bell mouth, or branch with a loss coefficient equivalent to that for the conical branch. The slopes of transitions shall be approximately one to five, and no abrupt changes or offsets of any kind in the duct system shall be permitted.
- K. Install round ducts in lengths not less than 12 feet unless interrupted by fittings.
- L. Install ducts with fewest possible joints.
- M. Install fabricated fittings for changes in directions, size, and shape and for connections.
- N. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.
- O. Install ducts vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs in ducts that would be over 12 feet in length.
- P. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- Q. Install ducts with a clearance of 2 inch on each side, plus allowance for insulation thickness.
- R. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
- S. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- T. Seal all joints and seams. If specification requires duct pressure test then duct sealant can be used instead of canvas and Arabol. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- U. Duct hangers shall be attached to horizontal slabs with steel angle clips secured with inserts, strapped to vertical walls, bolted to beams and joists, as per SMACNA guidelines, or as approved by the Architect.
- V. All ducts and equipment shall be blown out prior to operating.

- W. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures and telephone equipment rooms.
- X. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.
- Y. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers or combination fire/smoke dampers, sleeves.
- Z. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by California building codes.
- AA. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."
- BB. Do not paint interiors of metal ducts.
- CC. Protect duct openings from damage and prevent entrance of foreign materials.

3.4 INSTALLATION OF FLEXIBLE DUCTS

- A. Maximum length: For any duct run using flexible ductwork, do not exceed 7'- 0" extended length.
- B. Installation: Install in accordance with Section III of SMACNA's "HVAC Duct Construction Standards, Metal and Flexible", latest edition.
- C. Bends in flexible ducts shall have a radius of not less than 1.5 times the internal diameters.

3.5 EQUIPMENT CONNECTIONS

- A. General: Connect metal ductwork to equipment as indicated. Provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotary machinery. Provide access doors as indicated.

3.6 HANGING AND SUPPORTING

- A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.
- B. Support vertical ducts at maximum intervals of 16 feet and at each floor.

- C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load. Wire and friction clamps shall not be used.
- D. Install concrete inserts before placing concrete.
- E. Install drilled in concrete anchors after concrete is placed and completely cured.
- F. Do not use powder-actuated concrete fasteners.

3.7 INTERFACE WITH OTHER PRODUCTS

- A. Install openings in ductwork where required to accommodate thermometers and controllers. Install Pitot tube openings for testing of systems. Install Pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.
- B. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 to 7 feet maximum length of flexible duct held in place with strap or clamp except as otherwise shown on the drawings. Do not use flexible duct on moisture laden air systems.
- C. Connect air terminal units to supply ducts directly with at least one duct size larger than air terminal connection, except as shown otherwise on the drawings.

3.8 CLEANING NEW SYSTEM

- A. Division 01 - Execution and Closeout Requirements: Final cleaning.
- B. If the ductwork system is maintained in a clean state during the installation the following is not required. If in the opinion of the Architect/Engineer or Owner's Representative the ductwork system is dirty the following shall be complied with.
- C. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.
- D. Use service openings, as required, for physical and mechanical entry and for inspection.
- E. Create other openings to comply with duct standards.
- F. Disconnect flexible ducts as needed for cleaning and inspection.
- G. Remove and reinstall ceiling sections to gain access during the cleaning process.
- H. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.

- I. Clean the following metal duct systems by removing surface contaminants and deposits:
1. Air outlets and inlets (registers, grilles, and diffusers).
 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 4. Coils and related components.
 5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
 6. Supply-air ducts, dampers, actuators, and turning vanes.
- J. Cleaning Requirements:
1. Interior surfaces of all supply ductwork shall be cleaned of dust and dirt at the fabrication shop during fabrication.
 2. Supply Ductwork shall be sealed to protect interior surfaces prior to being shipped and handled.
 3. Seals and wrapping shall be removed on job site at time of installation.
 4. Seal open duct ends during at the end of each day.
- K. Mechanical Cleaning Methodology:
1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
 4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet.
 5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
- L. Cleanliness Verification:
1. Visually inspect metal ducts for contaminants.
 2. Where contaminants are discovered, re-clean and re-inspect ducts.

3.9 SCHEDULES

A.	Ductwork	Material	Schedule:

AIR SYSTEM	MATERIAL
Supply (Heating Systems)	Steel
Supply (System with Cooling Coils)	Steel
Return and Relief	Steel
General Exhaust	Steel
Outside Air Intake	Steel
Toilet/Shower Area Exhaust	Aluminum
Kitchen Hood	Stainless steel

- B. Static-Pressure Classes: Construct ducts according to the following:
1. Supply Ducts (Positive Pressure): 2 –inch wg.
 2. Return Ducts (Negative Pressure): 2-inch wg.
 3. General Exhaust Ducts (Negative Pressure): 2-inch wg.

END OF SECTION 233100

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Backdraft dampers.
 - 2. Combination fire-and-smoke dampers.
 - 3. Duct access doors.
 - 4. Volume control dampers.
 - 5. Flexible duct connections.
 - 6. Duct test holes.
 - 7. Remote control balancing system.

1.2 REFERENCES

- A. Air Movement and Control Association International, Inc.:
 - 1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.
- B. National Fire Protection Association:
 - 1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
- C. Sheet Metal and Air Conditioning Contractors:
 - 1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- D. Underwriters Laboratories Inc.:
 - 1. UL 555 - Standard for Safety for Fire Dampers.
 - 2. UL 555C - Standard for Safety for Ceiling Dampers.
 - 3. UL 555S - Standard for Safety for Smoke Dampers.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Submittals.
- B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers duct access doors and duct test holes.
- C. Product Data: Submit data for shop fabricated assemblies and hardware used.
- D. Product Data: Submit for the following. Include where applicable electrical characteristics and connection requirements.
 - 1. Backdraft dampers.
 - 2. Combination smoke/fire dampers including locations and ratings.
 - 3. Flexible duct connections.
 - 4. Volume control dampers.
 - 5. Duct access doors.

6. Duct test holes.
 7. Flexible duct connectors.
 8. Remote control balancing system.
- E. Product Data: For combination fire and smoke dampers submit the following:
1. Include UL ratings, dynamic ratings, leakage, pressure drop and maximum pressure data.
 2. Indicate materials, construction, dimensions, and installation details.
 3. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.
- F. Manufacturer's Installation Instructions: Submit for Combination Smoke and Fire Dampers.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements.
- B. Project Record Documents: Record actual locations of access doors and test holes.
- C. Operation and Maintenance Data: Submit for Combination Smoke and Fire Dampers.

1.5 QUALITY ASSURANCE

- A. Dampers tested, rated and labeled in accordance with the latest UL requirements.
- B. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements.
- B. Protect dampers from damage to operating linkages and blades.
- C. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

- D. Storage: Store materials in a dry area indoor, protected from damage.
- E. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 COORDINATION

- A. SectDivision 01 – General Requirements – Project Coordination.
- B. Coordinate Work where appropriate with building control Work.

1.10 WARRANTY

- A. Division 01 – General Requirements – Warranties and Bonds.
- B. Furnish five year manufacturer warranty for duct accessories.

PART 2 - PRODUCTS

2.1 BACK- DRAFT DAMPER

- A. Manufacturers:
 - 1. Pottorff
 - 2. Ruskin
 - 3. Greenheck
- B. Product Description: Multi-Blade, back-draft dampers: Parallel-action, gravity-balanced, extruded aluminum. Blades, maximum 6 inch width, with felt or flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90-degree stop, steel ball bearings, and plated steel pivot pin. Furnish dampers with adjustment counter balance weight to permit setting for varying differential static pressure. Back draft damper shall be capable of adjusting to 0.025 inches of water pressure.

2.2 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers:
 - 1. Ruskin.
 - 2. Pottorff.
 - 3. Air Balance.
 - 4. Substitutions: Division 01 – General Requirements – Product Requirements.

- B. Furnish and install California State Fire Marshal approved combination smoke/fire dampers where shown on plans. The dampers shall meet all the requirements for smoke dampers per the latest edition of NFPA 90A and UL standards. Combination fire and smoke dampers shall be louver bladed type. Rating 1-1/2 hours for installation in one or two hour partitions. The units will incorporate a low friction design that provides overlapping. The blade edge seals will be silicone and provide a minimum Class 2 seal at 350 degrees as per UL 555S. The damper shall be capable of being remotely controlled and reset for pressurization and smoke evacuation. The fire releasing device will be a UL 33 listed HS10. Provide PI50 end switch and wire to RCP-1 (remote control panel) mounted on ceiling below respective fire smoke damper. The fire releasing device must also be listed by the CSFM for use with the damper assembly. Melting fusible links are not acceptable. The dampers shall be provided in sleeves with pre-mounted motor actuators and dual position indicators for remote annunciation. The damper must be able to fail open or close for smoke, depending on the system requirements. The motors must be Belind FSLF120 or FSLF24 and have a minimum 5 year warranty. The motors must be mounted on a bracket that allows for use of slip joint connections or "Duct-mate" type connections without modification. The complete assembly must be factory cycled and tested prior to shipment. Provide suitable access for inspection and servicing of each damper. All smoke/fire dampers shall be tested by the Contractor in the presence of the field inspector and the State Fire Marshal. This test shall be performed prior to the installation of the ceilings.
- C. Fabricate in accordance with NFPA 90A, UL 555, and UL 555S.
- D. Fire Resistance: 1-1/2 hours.
- E. Leakage Rating: Class I, maximum of 8 cfm at 4 inches wg differential pressure.

2.3 DUCT ACCESS DOORS

- A. Manufacturers:
1. Air Balance, Inc.
 2. Ruskin Manufacturing Co.
 3. Duro Dyne Corp.
 4. Substitutions: Section 016100 – Product Requirements.
- B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.
- C. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, furnish minimum 1 inch thick insulation with sheet metal cover.
1. Less than 12 inches square, secure with sash locks.
 2. Up to 18 inches Square: Furnish two hinges and two sash locks.
 3. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.

4. Larger Sizes: Furnish additional hinge.
5. Access panels with sheet metal screw fasteners are not acceptable.

2.4 VOLUME CONTROL DAMPERS

- A. Manufacturers:
 1. Young Regulator.
 2. Duro Dyne Corp.
 3. Ventfabrics, Inc.
 4. Substitutions: Division 01 – General Requirements– Product Requirements.
- B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.
- C. Splitter Dampers:
 1. Material: Same gage as duct to 24 inches size in both dimensions, and two gages heavier for sizes over 24 inches.
 2. Blade: Fabricate of double thickness sheet metal to streamline shape, secured with continuous hinge or rod.
 3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.
 4. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.
- D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware.
- E. End Bearings: Except in round ductwork 12 inches and smaller, furnish end bearings. On multiple blade dampers, furnish oil-impregnated nylon or sintered bronze bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches wg;.
- F. Quadrants:
 1. Furnish locking, indicating quadrant regulators on single and multi-blade dampers.
 2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
 3. Where rod lengths exceed 30 inches furnish regulator at both ends.

2.5 FLEXIBLE DUCT CONNECTIONS

- A. Manufacturers:
 1. Duro Dyne Corp.
 2. Ventfabrics, Inc.
 3. Substitutions: Division 01 – General Requirements – Product Requirements.

- B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.
- C. Connector: Fabric crimped into metal edging strip.
 - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density 30 oz per sq yd.
 - 2. Net Fabric Width: Approximately 3 inches wide.
 - 3. Metal: 3 inch wide, 24 gage galvanized steel.
- D. Lead Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs. per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

2.6 DUCT TEST HOLES

- A. Manufacturers:
 - 1. Young Regulator.
 - 2. Duro Dyne Corp.
 - 3. Ventfabrics, Inc.
 - 4. Substitutions: Section 016100 - Product Requirements.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Furnish extended neck fittings to clear insulation.

2.7 REMOTE CONTROL BALANCING SYSTEM

- A. Manufacturers:
 - 1. Power/Balance System as manufactured by United Enertech Corp.
 - 2. Pottorff.
- B. The remote control system shall provide means of balancing airflow in ductwork above inaccessible ceilings.
- C. In these areas, the Contractor shall furnish and install Model Hi-i-3 at supply duct take-offs. The drive actuator shall be DC voltage.
- D. The Contractor shall furnish and install remote plate options of Model J50, J100, J150 or J300 terminal point. Color shall be white unless otherwise female outlet. Plenum rated cables are capable of lengths up to 1000 feet.
- E. The Contractor shall connect RJ-1 plenum rated cable from the damper to the specified. Model J300 has zinc plated steel faceplate.
- F. The balancing shall be achieved with a hand held power pack, utilizing an RJ-11 connector. Contractor shall turn over the hand held power packs to the Owner after balancing is complete.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements – Project Coordination.
- B. Verify rated walls are ready for fire damper installation.
- C. Verify ducts and equipment installation are ready for accessories.
- D. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.2 INSTALLATION.

- A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 233100 for duct construction and pressure class.
- B. Provide a volume control for each grille and diffuser and in all other locations necessary to properly balance the system.
- C. Quadrants on insulated ducts shall be mounted on sheet metal brackets, set flush with the insulation.
- D. Install back-draft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated on Drawings. Back draft dampers are not required for the fans with continuous operation and kitchen exhaust fans.
- E. Access Doors: Install access doors at the following locations :
 - 1. Spaced every 50 feet of straight duct.
 - 2. Upstream of each elbow.
 - 3. Before and after each combination fire and smoke damper.
- F. Access Door Sizes: Install minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access. Review locations prior to fabrication.
 - 1. Mark access doors for fire and smoke dampers on outside surface, with minimum 1/2 inch high letters reading: FIRE/SMOKE DAMPER.
- G. Install permanent duct test holes and required for testing and balancing purposes.
- H. Install combination fire and smoke dampers at locations as indicated on Drawings. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
 - 1. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.
 - 2. Install dampers square and free from racking with blades running horizontally.

3. Do not compress or stretch damper frame into duct or opening.
 4. Handle damper using sleeve or frame. Do not lift damper using blades, actuator, or jack shaft.
 5. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.
- I. Provide remote control balancing system for balancing dampers located in hard ceilings.

3.3 DEMONSTRATION

- A. Division 01 – General Requirements – Project Closeout.
- B. Demonstrate re-setting of combination/smoke fire dampers to Owner's representative.

END OF SECTION 233300

SECTION 233400 - HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Ceiling fans.

1.2 REFERENCES

- A. American Bearing Manufacturers Association:
 - 1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
 - 2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- B. Air Movement and Control Association International, Inc.:
 - 1. AMCA 99 - Standards Handbook.
 - 2. AMCA 204 - Balance Quality and Vibration Levels for Fans.
 - 3. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
 - 4. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
 - 5. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- C. American Refrigeration Institute:
 - 1. ARI 1060 - Air-to-Air Energy Recovery Ventilation Equipment Certification Equipment Program.
- D. ASTM International:
 - 1. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
- E. National Electrical Manufacturers Association:
 - 1. NEMA MG 1 - Motors and Generators.
 - 2. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- F. Underwriters Laboratories Inc.:
 - 1. UL 705 - Power Ventilators.

1.3 SUBMITTALS

- A. Division 01 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork and accessory connections.
- C. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels

for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.

- D. Manufacturer's Installation Instructions: Submit fan manufacturer's instructions.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 QUALITY ASSURANCE

- A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.
- B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.
- C. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- D. Balance Quality: Conform to AMCA 204.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - General Requirements: Product storage and handling requirements.
- B. Protect motors, shafts, and bearings from weather and construction dust.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 WARRANTY

- A. Division 01 - General Requirements: Product warranties and product bonds.

- B. Furnish five year manufacturer's warranty for fans.

PART 2 - PRODUCTS

2.1 CEILING FANS

- A. Manufacturers:
1. Loren Cook Company.
 2. Greenheck Corp.
 3. Acme Engineering and Manufacturing Corp.
 4. Penn Ventilation.
 5. Substitutions: Division 01 - Product Requirements.
- B. Centrifugal Fan Unit: Direct driven with galvanized steel housing lined with 1/2 inch acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge opening, integral outlet duct collar. Discharge position convertible by moving interchangeable panels.
- C. Disconnect Switch: Cord and plug in housing or Fan mounted toggle switch for thermal overload protected motor.
- D. Grille: Painted steel.
- E. Wheel: Centrifugal forward curved type constructed of injection molded or polypropylene resin.
- F. Motor: Open drip proof type with permanently lubricated sealed bearings and thermal overload protection.
- G. Accessories:
1. Wall jack constructed of corrosion resistant, galvanized steel with baked enamel finish.
 2. Rubber-in-shear vibration isolator.
 3. Fan speed controller.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 - General Requirements: Coordination and project conditions.

3.2 INSTALLATION

- A. Provide backdraft dampers on outlet from cabinet and ceiling fans and as indicated on Drawings.
- B. Install safety screen where inlet or outlet is exposed.

- C. Provide sheaves required for final air balance.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Division 01 - General Requirements: Requirements for manufacturer's field services.
- B. Furnish services of factory trained representative for minimum of two days to start-up, calibrate controls, and instruct Owner on operation and maintenance.

3.4 DEMONSTRATION

- A. Division 01 - General Requirements: Requirements for demonstration and training.
- B. Demonstrate fan operation and maintenance procedures.

3.5 PROTECTION OF FINISHED WORK

- A. Division 01 - General Requirements: Requirements for protecting finished Work.
- B. Do not operate fans for until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION 233400

SECTION 23 37 00 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Diffusers.
 - 2. Registers
 - 3. Grilles.
 - 4. Louvers.
- B. Related Sections:
 - 1. Division 08 - Louvers: Wall Louvers.
 - 2. Division 09 - Painting and Coating: Execution and product requirements for Painting of ductwork visible behind outlets and inlets specified by this section.
 - 3. Section 23 33 00 - Air Duct Accessories: Volume dampers for inlets and outlets.

1.2 REFERENCES

- A. Air Movement and Control Association International, Inc.:
 - 1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets.
- C. Sheet Metal and Air Conditioning Contractors:
 - 1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

- A. Division 01 - General Requirements: Submittal procedures.
- B. Product Data: Submit sizes, finish, and type of mounting. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
- C. Test Reports: Rating of air outlet and inlet performance.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- E. Acceptance or no exceptions taken by the engineer on any substitution proposed by the contractor shall not be construed as relieving the contractor from compliance with the project's specifications and performance requirements nor departure there from. The contractor remains responsible for details and

accuracy for confirming and correlating quantities and dimensions and for the selection of fabrication processes, techniques and assembly, coordination of his work with that of all other trades and making any needed modifications consequent to the substitution at his own cost and for performing the work in a safe manner.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - General Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of air outlets and inlets.

1.5 QUALITY ASSURANCE

- A. Test and rate diffuser, register, and grille performance in accordance with ASHRAE 70 and ADC 1062 "Certification, Rating and Test Manual".
- B. NFPA Compliance: Install air outlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilation Systems".

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 01 - General Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 WARRANTY

- A. Division 01 - General Requirements: Product warranties and product bonds.

1.9 EXTRA MATERIALS

- A. Division 01 - General Requirements: Spare parts and maintenance products.

PART 2 - PRODUCTS

2.1 CEILING AIR DIFFUSERS, REGISTERS, AND GRILLES

- A. Acceptable Manufacturers:
 - 1. Titus
 - 2. Price
 - 3. Krueger
 - 4. Metal-Aire

5. Substitutions: Division 01 - General Requirements - Product Requirements.
- B. General:
1. Grilles, registers, diffusers and appurtenances shall conform to requirements specified herein and shall be of type and sizes as specified and indicated on Drawings. Performance shall be in accordance with Air Diffusion Council Test Code 1602R2 including airflow velocity, pressure, temperature, and sound measurements. Noise level ratings shall be in accordance with ADC Test Code No. 1062RI and ASHRAE Standards 36 62 and 36B 3.
 2. Sponge neoprene, rubber, vinyl or felt border gaskets shall be provided for surface-mounted registers, grilles or diffusers.
 3. The noise generating characteristics of all specified grilles, registers, and diffusers shall be tested to, and comply with, all requirements of this specification. Representative samples shall be subjected to tests in accordance with applicable standards and procedures in order to demonstrate such compliance. A special test for this project is not required if the manufacturer has previous certified test results that can be made applicable to this project. Maximum Sound Levels of diffusers, grilles and registers shall be as follows:
 - a. Administrative office area: NC 30
 - b. Classrooms: NC 20
 - c. Libraries and other noise sensitive areas: NC 25
 4. Provide suitable frame types to match the ceiling types as specified or indicated on the Architectural Drawings.
 5. Ceiling diffusers shall be provided with equalizing deflectors.
 6. Ceiling mounted grilles, registers and diffusers shall be provided with a factory applied, baked enamel, dull finish, bone white to match acoustical ceiling tile.
 7. Grilles or registers mounted on painted walls or other surfaces shall be furnished with a baked prime coat and finish painted to match Architectural requirements.
 8. Do not provide opposed blade dampers at diffusers and registers for to balance the airflow, as they tend to create noise. Provide a manual volume damper at each branch take-off and also at branch duct to each diffuser and register. Air throw patterns shall be as indicated on the drawings.
 9. Diffusers, registers and grilles indicated or scheduled on the drawings to comply with special requirements shall take precedence over the standard items specified.
- C. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- D. Finishes: Ceiling diffusers, registers and grilles: Finishes shall be coordinated with the Architect.

- E. Diffusers and registers shall be provided with opposed blade volume dampers.

2.2 EXHAUST AND RETURN CEILING GRILLES

- A. Acceptable Manufacturer:
1. Titus
 2. Price
 3. Krueger
 4. Metal-Aire
 5. Substitutions: Division 01 - General Requirements - Product Requirements.
- B. Type: Streamlined blades, $\frac{3}{4}$ inch maximum spacing, with blades set at 45 degrees, horizontal face.
- C. Frame: 1 $\frac{1}{4}$ inch margin with countersunk screw mounting.
- D. Fabrication: Steel with 20 gage minimum frames and 22 gauge minimum blades, steel and aluminum with 20 gauge minimum frame, or aluminum extrusions, with factory off-white enamel, baked enamel finish.
- E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

2.3 CEILING SUPPLY DIFFUSERS

- A. Acceptable Manufacturer:
1. Titus
 2. Price
 3. Krueger
 4. Metal-Aire
 5. Substitutions: Division 01 - General Requirements - Product Requirements.
- B. Material: Steel or Aluminum.
- C. Finish: Baked enamel, White or off-white as selected by the Architect.
- D. Pattern: Adjustable from 1-4 way throw.
- E. Mounting: Surface mounted or Lay-in.
- F. Provide filler panel when installed in 24" X 24" T-bar ceiling. Panel to match ceiling construction. For 24" x 48" T-bar ceilings, coordinate with ceiling installer for auxiliary tees as required to provide 24" x 24" space. Where full 24" x 24" grid module is not available, surface mount the outlet in center cut to fit ceiling tile.
- G. Ceiling diffusers in rooms without lay-in T-Bar ceiling shall have frame suitable for ceiling type and as approved by Architect/Engineer.

2.4 WALL SUPPLY REGISTERS/GRILLES

- A. Manufacturers:
1. Titus.
 2. Anemostat Air Products.
 3. E. H Price Company.
 4. Krueger.
 5. Nailor Industries, Inc.
 6. Tuttle and Bailey.
 7. Substitutions: Division 01 - General Requirements - Product Requirements.
- B. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, vertical face, double deflection.
- C. Frame: 1-1/4 inch margin with concealed mounting and gasket.
- D. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory off-white enamel.
- E. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.
- F. Gymnasiums: Furnish front pivoted or welded in place blades, securely fastened to be immobile.

2.5 LOUVERS

- A. Louvers: As specified in Division 08.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 - General Requirements: Coordination and project conditions.
- B. Verify inlet and outlet locations.
- C. Verify ceiling and wall systems are ready for installation.
- D. Verify exact air inlet and outlet type with equipment schedules on drawings and reflected ceiling plans.

3.2 INSTALLATION

- A. Install diffusers to ductwork with airtight connection.

- B. Install balancing dampers on duct take-off to diffusers, grilles, and registers, whether or not dampers are furnished as part of diffuser, grille, and register assembly. Refer to Division 23, Air Duct Accessories.
- C. Paint visible portion of ductwork behind air outlets and inlets matte black. Refer to Division 09.

3.3 DIFFUSERS, REGISTERS AND GRILLES INSTALLATION

- A. Coordination with Ceiling Features.
 - 1. Install components to insure that all return air registers are located away from and in a neutral position with respect to any Television, computer station, refrigerators, stoves, microwave ovens, doors and windows. The thermostat will be located such that it senses the average return air temperature most accurately. These requirements and all components will be outlined on the shop drawings from the HVAC contractor early in the submittal phase for the approval of the design engineer.
 - 2. Install all inlets and outlets as close as possible to that shown on the plans but adjust to fit into the ceiling materials shown on the Architectural, Electrical and Fire Sprinkler plans. All ceiling mounted inlet and outlet devices shall be of the side inlet design and insulated for noise control.
 - 3. In dry wall and plaster ceilings, diffuser, register or grilled trim shall overlap the plaster line with adequate trim.
 - 4. In ceilings with acoustic tile adhesively applied to drywall or plaster ceilings, furnish diffusers, registers or grilles with overlapping margins.
 - 5. Furnish and install plaster frames for diffusers, grilles and registers which are located on finish plaster surfaces. Plaster frames for grilles and registers shall be set flush with the finished surface and attached to ductwork by hickey punching, with rivets or sheet metal screws. Grilles and registers shall be fastened to the frames with sheet metal screws. All inlet and outlet devices shall be Casketed for air tight mounting.
 - 6. Provide any intake duct not protected by a louver, grille or register with a 1/4" mesh galvanized screen over open end.
 - 7. Paint all ductwork visible through grilles, registers, and other openings with one coat of flat black paint.

3.4 INTERFACE WITH OTHER PRODUCTS

- A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

END OF SECTION 233700

SECTION 23 40 00 - HVAC AIR CLEANING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pre-filters.
 - 2. Temporary construction filters.
 - 3. Universal holding frames.
- B. Related Sections:
 - 1. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for wiring products for placement by this section.

1.2 REFERENCES

- A. Air-Conditioning and Refrigeration Institute:
 - 1. ARI 850 - Commercial and Industrial Air Filter Equipment.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
- C. Military Standardization Documents:
 - 1. MIL MIL-STD-282 - Filter Units, Protective Clothing, Gas-Mask Components, and Related Products: Performance-Test Methods.
- D. Underwriters Laboratories Inc.:
 - 1. UL 586 - High-Efficiency. Particulate, Air Filter Units.
 - 2. UL 867 - Electrostatic Air Cleaners.
 - 3. UL 900 - Air Filter Units.

1.3 PERFORMANCE REQUIREMENTS

- A. Conform to ARI 850 Section 7.4.

1.4 SUBMITTALS

- A. Division 01 - General Requirements: Submittal procedures.
- B. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.
- C. Product Data: Submit data on filter media, filter performance data, dimensions, and electrical characteristics.

- D. Manufacturer's Installation Instructions: Submit assembly and change-out procedures.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- F. Acceptance or no exceptions taken by the engineer on any substitution proposed by the contractor shall not be construed as relieving the contractor from compliance with the project's specifications and performance requirements nor departure there from. The contractor remains responsible for details and accuracy for confirming and correlating quantities and dimensions and for the selection of fabrication processes, techniques and assembly, coordination of his work with that of all other trades and making any needed modifications consequent to the substitution at his own cost and for performing the work in a safe manner.

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 - General Requirements: Closeout procedures.
- B. Operation and Maintenance Data: Submit instructions for operation, changing, and periodic cleaning.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 01 - General Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 WARRANTY

- A. Division 01 - General Requirements: Product warranties and product bonds.
- B. Furnish one year manufacturer warranty for air cleaning devices.

1.9 EXTRA MATERIALS

- A. Division 01 - General Requirements: Spare parts and maintenance products.
- B. Furnish one set of disposable panel filters.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Filtration Group – Aerostar
- B. Flanders Filters Inc.
- C. Burke Environmental
- D. Cam-Fil/Farr Company
- E. American Air Filter
- F. Or equal

2.2 FILTERS

- A. Types.
 - 1. Filter shall be AAF AMAir 62 Plus with Intersept or equal. Panel filter shall be a 1" cotton polyester pleat which exceeds ASHRAE 62-1989 R Standards for minimum filtration efficiency of Merv8 with Intercept, (durable, low toxicity, broad spectrum antimicrobial that inhibits the growth of mildew, bacteria, and fungi on filter media).
 - 2. Filter face velocity shall not exceed 300 FPM at nominal airflows.
 - 3. Filter shall be U.L. listed Class 2.
 - 4. Filter shall have a maximum rating as follows: flame spread 25, fuel contribution 50, smoke development 50.
 - 5. Provide the larger of a minimum of (24) spare filters, or one filter for each unit supplied, delivered to the Owner.
- B. Certification:
 - 1. Include an individual test report for each type of filter prepared by an independent testing laboratory with test equipment specified in ASHRAE Standard 52-81 using a 24-1/ x 24-1/2" duct section for the filter under test.
 - 2. Each test report shall include filter descriptive information and assurance that the construction and performance is in accordance with the Specifications.
 - 3. All filters tested shall have been procured by the independent testing laboratory from the open market independent of the manufacturer of these filters, and a statement of this fact shall accompany the submittal along with the test report.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Furnish units complete with start-up filters, retainer frames and housing certified to meet design requirements. The HVAC Sub-Contractor shall install them in the units prior to air balance.
- B. Install all air cleaning devices in accordance with approved shop drawings and the manufacturer's printed recommendations
- C. Install differential magnehelic pressure gauges across each filter bank.
- D. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.
- E. Do not operate fan system until filters (temporary) are in place. Replace temporary filter used during construction.
- F. Install static pressure tip on the up-stream side in an unobstructed area and not obstructing the removal of filters. Sensor on downstream side shall be a perforated tube transversing the filter face. Mount filter gages on outside of filter housing or filter plenum, in accessible position. Adjust and level.
- G. Provide alarm to indicate the time for change-out. Typical or all filter banks.
- H. Filter banks shall be installed without any measurable air leakages

3.2 TEMPORARY AND CONSTRUCTION FILTERS

- A. Provide (4) sets of 1-1/2 inch polyester media blankets to protect all pre filter banks during the construction period. Provide two (2) sets MERV8 filters for use in the pre filter bank during the construction period. At no time during the construction period are systems to be operated without blanket filters and filters.
- B. Blanket polyester media shall be used in conjunction with filters at all times
- C. The Contractor shall provide continuous maintenance of the temporary filters in all units during the entire construction, start-up, testing, and final acceptance activities. The Contractor shall provide additional temporary filters as necessary to facilitate completion of all start-up, testing and commissioning activities.
- D. After completion of the testing of the air handling equipment and systems and approval of same, but before final acceptance of the project, replace all filters and ensure that the correct quantity of spare filters are stored on site and signed for by the MUSD Project Management Team.

END OF SECTION 234000

SECTION 235400 - FURNACES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Gas Fired Furnaces.
 - 2. Evaporator Coil Units.
 - 3. Condensing Units.
 - 4. Thermostats.
- B. Related Sections:
 - 1. Section 231123 - Facility Natural-Gas Piping: Execution requirements for natural gas piping specified in this section.
 - 2. Section 233100 - HVAC Ducts and Casings: Execution requirements for ductwork and duct liner specified by this section.
 - 3. Section 233300 - Air Duct Accessories: Execution requirements for flexible duct connections specified by this section.
 - 4. Section 230923 - Direct Digital Control System for HVAC
 - 5. Section 260503 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI Z21.47 - Gas-Fired Central Furnaces.
- B. Air-Conditioning and Refrigeration Institute:
 - 1. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
 - 2. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
 - 3. ARI 520 - Positive Displacement Condensing Units.
- C. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 15 - Safety Code for Mechanical Refrigeration.
- D. National Electrical Manufacturers Association:
 - 1. NEMA MG 1 - Motors and Generators.
- E. National Fire Protection Association:
 - 1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
 - 2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
- F. Underwriters Laboratories Inc.:

1. UL 207 - Refrigerant-Containing Components and Accessories, Nonelectrical.

1.3 SUBMITTALS

- A. Division 01 - General Requirements: Submittal Procedures.
- B. Product Data: Submit rated capacities, efficiencies, weights, required clearances, and location and size of field connections, accessories, electrical nameplate data, and wiring diagrams.
- C. Design Data: Indicate refrigerant pipe sizing.
- D. Manufacturer's Installation Instructions: Submit rigging, assembly, and installation instructions.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - General Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of components and connections.
- C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, service instructions, installation instructions, maintenance and repair data, and parts listing.

1.5 QUALITY ASSURANCE

- A. Furnace Performance Requirements: Conform to minimum efficiency prescribed by ASHRAE 90.1 when tested in accordance with DOE 10 CFR, ANSI Z21.47 and UL 727.
- B. Perform Work in accordance with State of California standard.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - General Requirements: Product storage and handling requirements.

- B. Accept furnaces, condensing units and thermostats on site in factory packaging. Inspect for damage.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 - General Requirements.

1.9 WARRANTY

- A. Division 01 - General Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer's warranty for heat exchangers, condensing units and compressors.

1.10 EXTRA MATERIALS

- A. Division 01 - General Requirements: Spare parts and maintenance products.
- B. Furnish two filters for each furnace.

PART 2 - PRODUCTS

2.1 GAS FIRED FURNACES

- A. Manufacturers:
 - 1. York International.
 - 2. The Trane Company.
 - 3. Carrier Corp.
 - 4. Substitutions: Division 01 - General Requirements - Product Requirements.
- B. Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating element, controls, air filter and accessories; wired for single power connection with control transformer.
 - 1. Air Flow Configuration: Horizontal.
 - 2. Fuel: Natural gas fired.
 - 3. Electric Refrigeration: Refrigerant cooling coil and outdoor package containing compressor, condenser coil and condenser fan.
 - 4. Accessories: Concentric roof termination kit.
- C. Casing: Casing shall be of .030 in. thickness minimum, pre-painted galvanized steel.
- D. Blower Wheel: Galvanized blower wheel shall be centrifugal type, statically and dynamically balanced.

- E. Blower Motor: Blower motor of PSC type shall be permanently lubricated with sealed bearings, and shall be multiple-speed direct drive. Blower motor shall be soft mounted to the blower scroll to reduce vibration transmission.
- F. Variable Speed Motor: Motor shall be soft mounted to reduce vibration transmission.
- G. Heat Exchangers:
 - 1. Primary Heat Exchangers: Primary Heat exchangers shall be 3-Pass 20 gauge corrosion resistant aluminized steel of fold-and-crimp sectional design, which operates under negative pressure.
 - 2. Secondary Heat Exchangers: Secondary Heat exchangers shall be of a flow-through design having a patented interior laminate coating of polypropylene for greater corrosion resistance with fold-and-crimp design, which operates under negative pressure.
- H. Controls: Controls shall include a microprocessor based integrated electronic control board with at least 11 service troubleshooting codes displayed via diagnostic flashing LED light on the control, has ability to store fault codes, when activated a self-test feature checks all major functions of the furnace within one minute, and a replaceable automotive-type circuit protection fuse. Multiple operational settings available including, separate blower speeds for low heat, high heat, low cooling, high cooling and continuous fan. Continuous fan speed may be adjusted from the thermostat. Cooling airflow will be selectable between 350 or 400 CFM per ton of air conditioning. Features will also include temporary reduced airflow in the cooling mode for improved dehumidification when a Thermostat® is selected as the thermostat.
- I. Gas Burner: Components shall include: slow-opening dual rate gas valve to reduce ignition noise, regulate gas flow, with electric switch gas shut-off; flame proving sensor, hot surface igniter, pressure switch assembly verifies inducer operation; flame rollout switch, drain tubing and installed condensate drain trap, blower and inducer assembly, 40va transformer; low-voltage heating/cooling thermostat.
- J. Operating Controls:
 - 1. Room Thermostat: See Section 230923 Direct Digital Control System for HVAC.
 - 2. Supply Fan Control: Energize from outlet air temperature or timer device independent of burner controls, with adjustable timed off delay and fixed timed on delay, with manual switch for continuous fan operation. Provide continuous fan operation.
- K. Air Filters: See Section 234000, HVAC Air Cleaning Devices.

2.2 EVAPORATOR COIL UNITS

- A. Manufacturers:
 - 1. York International.

2. The Trane Company.
3. Carrier Corp.
4. Substitutions: Division 01 - General Requirements - Product Requirements.

B. Construction and Ratings: In accordance with ARI 210/240, and UL 207.

C. Evaporator Coil: Copper tube aluminum fin assembly, galvanized or polymeric drain pan, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve, steel cabinet with baked enamel finish and insulation. Refrigerant shall be 410a.

2.3 CONDENSING UNITS

A. Manufacturers:

1. York International.
2. The Trane Company.
3. Carrier Corp.
4. Substitutions: Division 01 - General Requirements - Product Requirements.

B. Construction and Ratings: In accordance with ARI 210/240, and UL 207. Testing: ASHRAE 15.

C. Unit Cabinet: Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a powder coat paint.

D. Fans:

1. Outdoor fans shall be direct-drive propeller type, and shall discharge air horizontally. Fans shall blow air through the outdoor coil.
2. Outdoor fan motors shall be totally enclosed, single-phase motors with class B insulation and permanently lubricated bearings. Shafts will be corrosion resistant.
3. Shaft shall have inherent corrosion resistance.
4. Fan blades shall be corrosion resistant and shall be statically and dynamically balanced.
5. Outdoor fan openings will be equipped with coated steel wire safety guards.

E. Compressor.

1. Compressor will be hermetically sealed.
2. Compressor assembly shall be installed on rubber vibration isolators.
3. Compressors shall be single-phase or 3-phase as specified on the contract drawings.

F. Outdoor Coil: Coil shall be constructed of aluminum fins mechanically bonded to internally enhanced, seamless copper tubes, which are cleaned, dehydrated, and sealed.

- G. Refrigeration Components:
1. Refrigeration circuit components will include liquid-line front-seating shutoff valve with sweat connections, vapor-line front seating shutoff valve with sweat connections, system charge of Puron® (R-410A) refrigerant, and compressor oil.
 2. Unit will be equipped with high-pressure switch, low pressure switch and filter drier for Puron refrigerant..
- H. Controls and Safeties: Operating controls and safeties shall be factory selected, assembled, and tested. The minimum control functions shall include the following:
1. Controls:
 - a. Time delay restart to prevent compressor reverse rotation on single-phase scroll compressors.
 - b. Automatic restart on power failure.
 - c. Safety lockout if any outdoor unit safety is open.
 - d. A time delay control sequence provided through the fan coil board, thermostat, or controller.
 - e. Liquid line low-pressure switches.
 - f. Automatic outdoor-fan motor protection.
 2. Safeties:
 - a. System diagnostics.
 - b. Compressor motor current and temperature overload protection.
 - c. High-pressure relief.
 - d. Outdoor fan failure protection.
- I. Electrical Requirements:
1. Units shall operate on three-phase, 60-cycle power at 208/230 v.
 2. Unit electrical power shall be a single point connection.
 3. All power and control wiring must be installed per NEC and all local building codes.
- J. Special Features (Field Installed)::
1. Low-Ambient Kit: Control shall regulate fan-motor cycles in response to saturated condensing, pressure of the unit. The control shall be capable of maintaining a condensing temperature of $100\text{ F} \pm 10\text{ F}$ with outdoor temperatures to -20 F . Installation of kit shall not require changing the outdoor-fan motor.
 2. Liquid Solenoid Valve: This electronically operated shutoff valve shall close and open in response to compressor operation. The valve should be used with all long-line applications (over 100 equivalent ft or 25-ft lift).
 3. Winter Start Control: Field installed winter start control shall permit start-up for cooling operation under low-load conditions and at low-ambient temperatures by bypassing the low-pressure switch for a 3-minute delay period.
 4. Crankcase Heater: An electric resistance heater which mounts to the base of the compressor to keep the lubricant warm during off cycles. A crankcase heater is required for low ambient operation.

5. Hard Start Kit: Field-installed accessory capacitor and start relay shall give a hard boost to compressor motor at each start.
6. Low pressure gas conversion kit. Field-installed accessory.

2.4 THERMOSTATS

- A. Room Thermostat: See Section 230923 Direct Digital Control System for HVAC.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 - General Requirements: Coordination and project conditions.

3.2 INSTALLATION

- A. Install Work in accordance with State of California standards.
- B. Install gas fired furnaces in accordance with NFPA 54.
- C. Install vent connections in accordance with NFPA 211 and NFPA 54.
- D. Install refrigeration systems in accordance with ASHRAE 15.
- E. Install condensate piping (furnaces, DX Coil primary and secondary) as per plumbing division.
- F. Mount air cooled condenser-compressor package on wooden platforms.
- G. Installation - Natural Gas Piping:
 1. Connect natural gas piping in accordance with NFPA 54.
 2. Connect natural gas piping to unit, full size of unit gas train inlet. Arrange piping with clearances for burner service.
 3. Install the piping accessories on natural gas piping connections per Section 231123.
- H. Connect units to electric supply and connect controls remote from units.
- I. Install control components supplied with equipment and provide control wiring.
- J. Install control wiring between thermostat, indoor unit, and outdoor unit.
- K. Install evaporator unit in section of lined ductwork fastened to furnace. Connect return air and evaporator unit duct to system ductwork with flexible duct connection. Refer to Section 233300.

END OF SECTION 235400

NOT FOR BID

SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fan coil unit.
 - 2. Condensing unit.
- B. Related Sections:
 - 1. Section 230548 - Vibration and Seismic Controls for HVAC Piping and Equipment: Vibration isolators.
 - 2. Section 232300 - Refrigerant Piping: Execution requirements for connection to refrigerant piping specified by this section.
 - 3. Section 230923 - Direct Digital Control System for HVAC.
 - 4. Section 260503 - Equipment Wiring Connections: Electrical connection to units.

1.2 REFERENCES

- A. Air-Conditioning and Refrigeration Institute:
 - 1. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
 - 2. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
 - 3. ARI 340/360 - Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
 - 4. ARI 365 - Commercial and Industrial Unitary Air-Conditioning Condensing Units.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
 - 2. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- C. ASTM International:
 - 1. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
- D. National Electrical Manufacturers Association:
 - 1. NEMA MG 1 - Motors and Generators.
- E. National Fire Protection Association:
 - 1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.

1.3 SUBMITTALS

- A. Division 01 - General Requirements: Submittal procedures.
- B. Product Data: Submit data indicating:
 - 1. Cooling and heating capacities.
 - 2. Dimensions.
 - 3. Weights.
 - 4. Rough-in connections and connection requirements.
 - 5. Electrical requirements with electrical characteristics and connection requirements.
 - 6. Controls.
 - 7. Accessories.
- C. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.
- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.
- E. Manufacturer's Field Reports: Submit start-up report for each unit.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 - General Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of controls installed remotely from units.
- C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.5 QUALITY ASSURANCE

- A. Performance Requirements: Energy Efficiency Rating (EER) not less than prescribed by ASHRAE 90.1 when used in combination with compressors and evaporator coils when tested in accordance with ARI 210/240.
- B. Cooling Capacity: Rate in accordance with ARI 210/240.
- C. Sound Rating: Measure in accordance with ARI 270.
- D. Insulation and adhesives: Meet requirements of NFPA 90A.
- E. Perform Work in accordance with State of California standards.
- F. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 01 - General Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - General Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.
- C. Comply with manufacturer's installation instruction for rigging, unloading and transporting units.
- D. Protect units from weather and construction traffic by storing in dry, roofed location.

1.9 COORDINATION

- A. Division 01 - General Requirements: Requirements for coordination.
- B. Coordinate installation of condensing units with roof structure.
- C. Coordinate installation of air handling units with building structure.

1.10 WARRANTY

- A. Division 01 - General Requirements: Requirements for warranties.
- B. Furnish five year manufacturer's warranty for compressors.

1.11 MAINTENANCE SERVICE

- A. Division 01 - General Requirements: Requirements for maintenance service.
- B. Furnish service and maintenance of equipment for one year from Date of Substantial Completion. Include maintenance items as shown in manufacturer's

operating and maintenance data, including filter replacements, fan belt replacement, and controls checkout and adjustments.

- C. Furnish 24-hour emergency service on breakdowns and malfunctions for this maintenance period. Furnish capability of response time within hours.

1.12 MAINTENANCE MATERIALS

- A. Division 01 - General Requirements: Requirements for maintenance materials.

PART 2 - PRODUCTS

2.1 SPLIT SYSTEM AIR CONDITIONING UNITS

- A. Manufacturers:
 - 1. Mitsubishi
 - 2. Sanyo.
 - 3. Toshiba.
 - 4. Substitutions: Section 016100 - Product Requirements.
- B. Product Description: Split system consisting of fan coil unit and condensing unit including cabinet, evaporator fan, refrigerant cooling coil, compressor, refrigeration circuit, condenser, air filters, controls, air handling unit accessories, condensing unit accessories, and refrigeration specialties.

2.2 FAN COIL UNIT

- A. General: Indoor, direct-expansion, wall-mounted fan coil. Unit shall be complete with cooling/heating coil, fan, fan motor, piping connectors, electrical controls, microprocessor control system, and integral temperature sensing. Unit shall be furnished with integral wall mounting bracket and mounting hardware.
- B. Unit Cabinet: Cabinet discharge and inlet grilles shall be attractively styled, high-impact polystyrene. Cabinet shall be fully insulated for improved thermal and acoustic performance.
- C. Fans:
 - 1. Fan shall be tangential direct-drive blower type with air intake at the top of the unit and discharge at the bottom front. Automatic, motor-driven vertical air sweep shall be provided standard.
 - 2. Air sweep operation shall be user selectable. The vertical sweep may be adjusted (using the remote control) and the horizontal air direction may be set manually.
- D. Coil: Coil shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins shall be bonded to the tubes by mechanical expansion. A drip pan under the coil shall have a drain connection for hose attachment to remove condensate. Condensate pan shall have internal trap.

- E. Motor: Motors shall be open drip-proof, permanently lubricated ball bearing with inherent overload protection. Fan motors shall be 3-speed.
- F. Controls:
 - 1. Controls shall consist of a microprocessor-based control system which shall control space temperature, determine optimum fan speed, and run self diagnostics. The temperature control range shall be from 62 deg F to 84 deg F.
 - 2. User interface with the unit shall be accomplished through the standard wireless remote control or an optional wired controller or Zone Manager. The unit shall have the following functions as a minimum:
 - a. An automatic restart after power failure at the same operating conditions as at failure.
 - b. A timer function to provide a minimum 24-hour timer cycle for system Auto Start/Stop.
 - c. Temperature-sensing controls shall sense return air temperature.
 - d. Indoor coil freeze protection.
 - e. Automatic air sweep control to provide on or off activation of air sweep louvers.
 - f. Fan-only operation to provide room air circulation when no cooling is required.
 - g. Fan speed control shall be user-selectable: high, medium, low, or microprocessor controlled automatic operation during all operating modes.
- G. Filters: Unit shall have filter track with factory-supplied cleanable filters.
- H. Refrigerant Lines: All units should have refrigerant lines that can be oriented to connect from the left, right or back of the unit. Both refrigerant lines need to be insulated.

2.3 CONDENSING UNIT

- A. Air-Cooled Condensing Unit (Outdoor Unit):
 - 1. System Description:
 - a. Outdoor-mounted, air-cooled, split-system air conditioning unit suitable for ground or rooftop installation. Unit shall consist of a scroll compressor, and air-cooled coil, propeller-type blow-thru condenser fan, accumulator, full refrigerant charge, and control box.
 - b. Unit shall discharge supply air HORIZONTALLY as shown on contract drawings.
 - c. Unit shall be used in a condensing unit circuit to match up to a fan coil unit.
 - 2. Quality Assurance:
 - a. Unit shall be rated in accordance with the latest edition of ARI Standard 210, and be certified for capacity, efficiency, and listed in the latest ARI directory.

- b. Unit construction shall comply with latest edition of ANSI/ASHRAE and with NEC.
 - c. Unit shall be constructed in accordance with UL standards and carry the UL label of approval.
 - d. Unit cabinet shall be capable of withstanding Federal Test Method Standard No. 141 (Method 6061) 500-hr salt spray test.
 - e. Air-cooled condenser coils shall be leak tested at 150 psig and pressure tested at 300 psig.
3. Equipment:
- a. Factory-assembled, single-piece air-cooled condensing unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor, refrigerant charge (R410A), and special features required prior to field start-up.
 - b. Unit cabinet shall be constructed of galvanized steel, bonderized, and coated with powder coat paint.
 - c. Condenser fan shall be direct-drive propeller type, discharging air horizontally. Condenser fan motors shall be totally enclosed, 1-phase type with class B insulation and permanently lubricated bearings. Shafts shall be corrosion resistant and fan blades shall be statically and dynamical balanced.
 - d. Condenser fan openings shall be equipped with PVC-coated steel wire safety guards.
 - e. Compressor will be hermetically sealed and mounted on rubber vibration isolators.
 - f. Condenser coil shall be air cooled and constructed of aluminum fins mechanically bonded to copper tubes, cleaned, dehydrated, and sealed.
 - g. Refrigeration circuit components shall include liquid line shutoff valve with sweat connections, suction line shutoff valves with sweat connections, system charge of refrigerant R410A, compressor oil, accumulator, bi-flow filter drier and pressure relief.

2.4 CONTROLS

- A. Thermostat: Hard-wired remote space thermostat with single stage cooling. Furnish system selector switch off-cool.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Verification of existing conditions before starting work.
- B. Verify concrete pad for condensing unit is ready for unit installation.

3.2 INSTALLATION - FAN COIL UNIT

- A. Install fan coil units as recommended by manufacturer.
- B. Install condensate piping per CMC and CPC regulations and as shown within the plumbing drawings and specifications.
- C. Install components furnished loose for field mounting.
- D. Install connection to electrical power wiring in accordance with Section 260503.

3.3 INSTALLATION - CONDENSING UNIT

- A. Install condensing units per manufacturer's instructions.
- B. Install units on equipment platforms. Refer to Division 03.
- C. Install refrigerant piping from unit to condensing unit. Install refrigerant specialties furnished with unit.
- D. Evacuate refrigerant piping and install initial charge of refrigerant.
- E. Install electrical devices furnished loose for field mounting.
- F. Install control wiring between fan coil unit, condensing unit, and field installed accessories.
- G. Install connection to electrical power wiring in accordance with Section 260503.

3.4 MANUFACTURER'S FIELD SERVICES

- A. Division 01 – General Requirements: Requirements for manufacturer's field services.
- B. Furnish initial start-up and shutdown during first year of operation, including routine servicing and checkout.

3.5 CLEANING

- A. Division 01 – General Requirements: Requirements for cleaning.
- B. Vacuum clean coils and inside of unit cabinet.

3.6 DEMONSTRATION

- A. Division 01 – General Requirements: Requirements for demonstration and training.
- B. Demonstrate fan coil unit operation and maintenance.

- C. Demonstrate starting, maintenance, and operation of condensing unit including low ambient temperature operation.
- D. Furnish services of manufacturer's technical representative for one 4-hour day to instruct Owner's personnel in operation and maintenance of units. Schedule training with Owner, provide at least 7 days notice to Architect/Engineer of training date.

3.7 PROTECTION OF FINISHED WORK

- A. Division 01 – General Requirements: Requirements for protecting finished Work.

END OF SECTION 238126

SECTION 260503 - EQUIPMENT WIRING CONNECTIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes electrical connections to equipment.
- B. Related Sections:
 - 1. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.
 - 2. Section 260533 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA WD 1 - General Requirements for Wiring Devices.
 - 2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

- A. Division 1 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- C. Manufacturer's installation instructions.

1.4 COORDINATION

- A. Division 01 – General Requirements: Coordination and project conditions.
- B. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
- C. Determine connection locations and requirements.
- D. Sequence rough-in of electrical connections to coordinate with installation of equipment.
- E. Sequence electrical connections to coordinate with start-up of equipment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Coordination and project conditions.
- B. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.2 EXISTING WORK

- A. Remove exposed abandoned equipment wiring connections, including abandoned connections above accessible ceiling finishes.
- B. Disconnect abandoned utilization equipment and remove wiring connections. Remove abandoned components when connected raceway is abandoned and removed. Install blank cover for abandoned boxes and enclosures not removed.
- C. Extend existing equipment connections using materials and methods compatible with existing electrical installations, or as specified.

3.3 INSTALLATION

- A. Make electrical connections.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Install receptacle outlet to accommodate connection with attachment plug.
- E. Install cord and cap for field-supplied attachment plug.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

3.4 ADJUSTING

- A. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

END OF SECTION 260503

NOT FOR BID

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes building wire and cable; nonmetallic-sheathed cable; direct burial cable; service entrance cable; armored cable; metal clad cable; and wiring connectors and connections.
- B. Related Sections:
 - 1. Section 260553 - Identification for Electrical Systems: Product requirements for wire identification.

1.2 REFERENCES

- A. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- B. National Fire Protection Association:
 - 1. NFPA 70 - National Electrical Code.
 - 2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
- C. Underwriters Laboratories, Inc.:
 - 1. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.3 SYSTEM DESCRIPTION

- A. Product Requirements: Provide products as follows:
 - 1. Solid or Stranded conductor for feeders and branch circuits 10 AWG and smaller.
 - 2. Stranded conductors for control circuits.
 - 3. Conductor not smaller than 12 AWG for power and lighting circuits.
 - 4. Conductor not smaller than 16 AWG for control circuits.
 - 5. Increase wire size in branch circuits to limit voltage drop to a maximum of 3 percent.
- B. Wiring Methods: Provide the following wiring methods:
 - 1. Concealed Dry Interior Locations: Use only Type THHN/THWN insulation in raceway.
 - 2. Exposed Dry Interior Locations: Use only Type THHN/THWN or XHHW insulation in raceway.
 - 3. Wet or Damp Interior Locations: Use only Type XHHW/THWN insulation in raceway.

4. Exterior Locations: Use Type THWN or XHHW insulation in raceway
5. Underground Locations: Use only Type THWN or XHHW insulation.

1.4 DESIGN REQUIREMENTS

- A. Conductor sizes are based on copper.

1.5 SUBMITTALS

- A. Division 01 – General Requirements: Requirements for submittals.
- B. Product Data: Submit for building.
- C. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors.
- D. Test Reports: Indicate procedures and values obtained.

1.6 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of components and circuits.

1.7 QUALITY ASSURANCE

- A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements are as indicated on Drawings.

1.10 COORDINATION

- A. Division 01 – General Requirements: Requirements for coordination.
- B. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.
- C. Wire and cable routing indicated is approximate unless dimensioned.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

- A. Manufacturers:
 - 1. CERO Wire.
 - 2. American Insulated Wire Corp.
 - 3. Rome Cable.
- B. Product Description: Single conductor insulated wire.
- C. Conductor: Copper.
- D. Insulation Voltage Rating: 600 volts.
- E. Insulation Temperature Rating: 90 degrees C.
- F. Insulation Material: Thermoplastic.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Coordination and project conditions.
- B. Verify interior of building has been protected from weather.
- C. Verify mechanical work likely to damage wire and cable has been completed.
- D. Verify raceway installation is complete and supported.

3.2 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

- A. Route wire and cable to meet Project conditions.
- B. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- C. Identify and color code wire and cable under provisions of Section 260553. Identify each conductor with its circuit number or other designation indicated.
- D. Special Techniques--Building Wire in Raceway:
 - 1. Pull conductors into raceway at same time.
 - 2. Install building wire 4 AWG and larger with pulling equipment.

- E. Special Techniques - Cable:
 - 1. Protect exposed cable from damage.
 - 2. Support cables above accessible ceiling, using J-hook and cable ties to support cables from structure or ceiling suspension system. Do not rest cable on ceiling panels.
 - 3. Use suitable cable fittings and connectors.
- F. Special Techniques - Wiring Connections:
 - 1. Clean conductor surfaces before installing lugs and connectors.
 - 2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
 - 3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.
 - 4. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
 - 5. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
 - 6. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
 - 7. Terminate aluminum conductors with tin-plated, aluminum-bodied compression connectors only. Fill with anti-oxidant compound before installing conductor.
 - 8. Install suitable reducing connectors or mechanical connector adaptors for connecting aluminum conductors to copper conductors.
- G. Install stranded conductors for branch circuits 10 AWG and smaller. Install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.
- H. Install terminal lugs on ends of 600 volt wires unless lugs are furnished on connected device, such as circuit breakers.
- I. Size lugs in accordance with manufacturer's recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.
- J. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

3.4 WIRE COLOR

- A. General:
 - 1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:
 - a. Black and red for single phase circuits at 120/240 volts.

- b. Black, red, and blue for circuits at 120/208 volts single or three phase.
 - c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
 - 2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:
 - a. Black and red for single phase circuits at 120/240 volts.
 - b. Black, red, and blue for circuits at 120/208 volts single or three phase.
 - c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.
 - B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.
 - C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.
 - D. Feeder Circuit Conductors: Uniquely color code each phase.
 - E. Ground Conductors:
 - 1. For 6 AWG and smaller: Green.
 - 2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.
- 3.5 FIELD QUALITY CONTROL
- A. Inspect and test in accordance with NETA ATS, except Section 4.
 - B. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION 260519

NOT FOR BID

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wire.
 - 2. Mechanical connectors.

1.2 REFERENCES

- A. Institute of Electrical and Electronics Engineers:
 - 1. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
 - 2. IEEE 1100 - Recommended Practice for Powering and Grounding Electronic Equipment.
- B. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- C. National Fire Protection Association:
 - 1. CEC - California Electrical Code.

1.3 QUALITY ASSURANCE

- A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five (5) years experience.
- B. Installer: Company specializing in performing work of this section with minimum five (5) years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

- C. Do not deliver items to project before time of installation. Limit shipment of bulk and multiple-use materials to quantities needed for immediate installation.

PART 2 - PRODUCTS

2.1 WIRE

- A. Material: Stranded copper.
- B. Bonding Conductor: Copper conductor insulated.

2.2 MECHANICAL CONNECTORS

- A. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.3 GROUNDING WELL COMPONENTS

- A. Well Pipe: 8 inches NPS by 24 inches long, fiberglass pipe with belled end.
- B. Well Cover: Fiberglass with legend "Ground" embossed on cover.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove all paint, rust, mill oils, and surface contaminants at connection points.

3.2 INSTALLATION

- A. Install in accordance with IEEE 142 and 1100.
- B. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- C. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.
- D. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment.

- E. Permanently attach equipment and grounding conductors prior to energizing equipment.
- F. Bond main telecommunications grounding bus to building grounding electrode system at main electrical service entrance location with 6 AWG THHN, rated for 90 degrees C, insulated, copper stranded conductor.
- G. Install routing for grounding conductor as short and direct as practical.
- H. Install routing of bonding conductors with minimum number of bends and splices. Use sweeping bends.
- I. Install bonding connections with listed bolts, crimp pressure connectors, clamps, or lugs.

3.3 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. When improper grounding is found on receptacles, check receptacles in entire project and correct. Perform retest.

END OF SECTION 260526

NOT FOR BID

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Conduit supports.
 - 2. Formed steel channel.
 - 3. Spring steel clips.
 - 4. Equipment bases and supports.

1.2 REFERENCES

- A. National Fire Protection Association:
 - 1. CEC – California Electrical Code.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five (5) years documented experience.
- B. Installer: Company specializing in performing work of this section.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

PART 2 - PRODUCTS

2.1 CONDUIT SUPPORTS

- A. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.
- B. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

- C. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.
- D. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

2.2 FORMED STEEL CHANNEL

- A. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.3 SPRING STEEL CLIPS

- A. Product Description: Mounting hole and screw closure.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- B. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.2 INSTALLATION - HANGERS AND SUPPORTS

- A. Anchors and Fasteners:
 - 1. Steel Structural Elements: Provide beam clamps.
 - 2. Concrete Surfaces: Provide expansion anchors.
 - 3. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.
 - 4. Solid Masonry Walls: Provide expansion anchors.
 - 5. Sheet Metal: Provide sheet metal screws.
 - 6. Wood Elements: Provide wood screws.
- B. Inserts:
 - 1. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
- C. Install conduit and raceway support and spacing in accordance with NEC.
- D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- E. Install multiple conduit runs on common hangers.
- F. Supports:

1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
2. Install surface mounted cabinets and panelboards with minimum of four anchors.
3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.

3.3 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

3.4 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.5 PROTECTION OF FINISHED WORK

- A. Division 01 – General Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

END OF SECTION 260529

NOT FOR BID

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.
- B. Related Sections:
 - 1. Section 260526 - Grounding and Bonding for Electrical Systems.
 - 2. Section 260529 - Hangers and Supports for Electrical Systems.
 - 3. Section 260553 - Identification for Electrical Systems.
 - 4. Section 262726 - Wiring Devices.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
 - 2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
- B. National Electrical Manufacturers Association:
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
 - 3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 5. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
 - 6. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

- A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.
- B. Underground More than 5 feet outside Foundation Wall: Provide Schedule 40 PVC conduit.
- C. Underground Within 5 feet from Foundation Wall: Provide rigid galvanized steel
- D. In or Under Slab on Grade: Provide Schedule 40 PVC conduit.
- E. Outdoor Locations, Above Grade: Provide rigid steel conduit. Provide cast metal outlet, pull, and junction boxes.

- F. In Slab Above Grade: Provide Schedule 40 PVC conduit.
- G. Wet and Damp Locations: Provide rigid galvanized steel conduit. Provide cast metal outlet, junction, and pull boxes. Provide flush mounted outlet boxes in finished areas.
- H. Concealed Dry Locations: Provide electrical metallic tubing or metal clad cables. Provide sheet-metal boxes. Provide flush mounted outlet boxes in finished areas. Provide hinged enclosure for large pull boxes.
- I. Exposed Dry Locations: Provide rigid galvanized steel conduit. Provide sheet-metal boxes. Provide flush mounted outlet boxes in finished areas. Provide hinged enclosure for large pull boxes.
- J. Provide EMT conduit for homerun and metal clad cables beyond the first junction box or device for branch circuits wiring in lieu of complete EMT conduit system.

1.4 DESIGN REQUIREMENTS

- A. Minimum Raceway Size: 3/4 inch unless otherwise specified.

1.5 SUBMITTALS

- A. Product Data: Submit for the following:
 - 1. Flexible metal conduit.
 - 2. Liquidtight flexible metal conduit.
 - 3. Nonmetallic conduit.
 - 4. Raceway fittings.
 - 5. Conduit bodies.
 - 6. Pull and junction boxes.
 - 7. Handholes.
- B. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

- A. Project Record Documents:
 - 1. Record actual routing of conduits larger than 2 inch.
 - 2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

- B. Protect PVC conduit from sunlight.

1.8 COORDINATION

- A. Coordinate installation of outlet boxes for equipment connected under Section 260503.
- B. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 - PRODUCTS

2.1 METAL CONDUIT

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Fittings and Conduit Bodies: NEMA FB 1; all steel fittings.

2.2 FLEXIBLE METAL CONDUIT

- A. Product Description: Interlocked steel construction.
- B. Fittings: NEMA FB 1.

2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

- A. Product Description: Interlocked steel construction with PVC jacket.
- B. Fittings: NEMA FB 1.

2.4 ELECTRICAL METALLIC TUBING (EMT)

- A. Product Description: ANSI C80.3; galvanized tubing.
- B. Fittings and Conduit Bodies: NEMA FB 1; steel compression type.

2.5 NONMETALLIC CONDUIT

- A. Product Description: NEMA TC 2; Schedule 40 PVC.
- B. Fittings and Conduit Bodies: NEMA TC 3.

2.6 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.

- B. Cast Boxes: NEMA FB 1, Type FD, cast ferrous alloy. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.
- C. Wall Plates for Finished Areas: As specified in Section 262726.
- D. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.7 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Concrete Composite Handholes:
 - 1. Cover: Concrete composite, weatherproof cover with nonskid finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 1 - Administrative Requirements: Coordination and project conditions.
- B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 INSTALLATION

- A. Ground and bond raceway and boxes in accordance with Section 260526.
- B. Fasten raceway and box supports to structure and finishes in accordance with Section 260529.
- C. Identify raceway and boxes in accordance with Section 260553.
- D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.3 INSTALLATION - RACEWAY

- A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.
- B. Arrange raceway supports to prevent misalignment during wiring installation.
- C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 260529; provide space on each for 25 percent additional raceways.

- E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports
- F. Do not attach raceway to ceiling support wires or other piping systems.
- G. Construct wireway supports from steel channel specified in Section 260529.
- H. Route exposed raceway parallel and perpendicular to walls.
- I. Route raceway installed above accessible ceilings parallel and perpendicular to walls.
- J. Route conduit in and under slab from point-to-point.
- K. Maximum Size Conduit in Slab Above Grade: 3/4 inch. Do not cross conduits in slab.
- L. Maintain clearance between raceway and piping for maintenance purposes.
- M. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.
- N. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- O. Bring conduit to shoulder of fittings; fasten securely.
- P. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.
- Q. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations.
- R. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows for bends in metal conduit larger than 2 inch size.
- S. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.
- T. Install suitable pull string or cord in each empty raceway except sleeves and nipples.
- U. Install suitable caps to protect installed conduit against entrance of dirt and moisture.
- V. Support metal clad cable similar to raceway.

- W. All spare conduits or identified in plan as "conduit only" shall be provided with pulling cable or rope.

3.4 INSTALLATION - BOXES

- A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings.
- B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.
- C. Orient boxes to accommodate wiring devices oriented as specified in Section 262726.
- D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.
- H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- I. Install stamped steel bridges to fasten flush mounting outlet box between studs.
- J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- K. Install adjustable steel channel fasteners for hung ceiling outlet box.
- L. Do not fasten boxes to ceiling support wires or other piping systems.
- M. Support boxes independently of conduit.
- N. Install gang box where more than one device is mounted together. Do not use sectional box.
- O. Install gang box with plaster ring for single device outlets.

3.5 INTERFACE WITH OTHER PRODUCTS

- A. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.

- B. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.
- C. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.6 ADJUSTING

- A. Division 01 – General Requirements: Testing, adjusting, and balancing.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. Install knockout closures in unused openings in boxes.

3.7 CLEANING

- A. Clean interior of boxes to remove dust, debris, and other material.
- B. Clean exposed surfaces and restore finish.

END OF SECTION 260533

NOT FOR BID

SECTION 260548 - SEISMIC CONTROLS FOR ELECTRICAL WORK

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 seismic restraints and other earthquake-damage-reduction measures for electrical components. It complements optional seismic construction requirements in the various electrical component Sections.

1.3 DEFINITIONS

- A. BOCA: BOCA National Building Code.
- B. SBC: Standard Building Code.
- C. UBC: Uniform Building Code.
- D. Seismic Restraint: A fixed device (a seismic brace, an anchor bolt or stud, or a fastening assembly) used to prevent vertical or horizontal movement, or both vertical and horizontal movement, of an electrical system component during an earthquake.
- E. Mobile Structural Element: A part of the building structure such as a slab, floor structure, or wall that may move independent of other mobile structural elements during an earthquake

1.4 SUBMITTALS

- A. Product Data: Illustrate and indicate types, styles, materials, strength, fastening provisions, and finish for each type and size of seismic restraint component used.
 - 1. Anchor Bolts and Studs: Tabulate types and sizes, complete with report numbers and rated strength in tension and shear as evaluated by ICBO Evaluation Service.
- B. Shop Drawings: For anchorage and bracing not defined by details and charts in Drawings. Indicate materials, and show designs and calculations signed and sealed by a professional engineer.
 - 1. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.

2. Details: Detail fabrication and arrangement. Detail attachment of restraints to both structural and restrained items. Show attachment locations, methods, and spacings, identifying components and listing their strengths. Indicate direction and value of forces transmitted to the structure during seismic events.
 3. Preapproval and Evaluation Documentation: By ICBO Evaluation Service, showing maximum ratings of restraints and the basis for approval (tests or calculations).
 4. Coordination Drawings: Plans and sections drawn to scale and coordinating seismic bracing for electrical components with other systems and equipment, including other seismic restraints, in the vicinity.
- C. Product Certificates: Signed by manufacturers of seismic restraints certifying that products furnished comply with requirements.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- E. Material Test Reports: From a qualified testing agency indicating and interpreting test results of seismic control devices for compliance with requirements indicated.

1.5 QUALITY ASSURANCE

- A. Comply with seismic restraint requirements in California Building Code, unless requirements in this Section are more stringent.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing seismic engineering services, including the design of seismic restraints, that are similar to those indicated for this Project.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated.

1.6 PROJECT CONDITIONS

- A. Project Seismic Zone and Zone Factor as Defined in UBC: Zone 4, Zone Factor 0.40.
- B. Occupancy Category as Defined in UBC: IV.
- C. Acceleration Factor: 0.5G.

1.7 COORDINATION

- A. Coordinate layout and installation of seismic bracing with building structural system and architectural features, and with mechanical, fire-protection, electrical, and other building features in the vicinity.
- B. Coordinate concrete bases with building structural 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amber/Booth Company, Inc.
 - 2. B-Line Systems, Inc.
 - 3. Erico, Inc.
 - 4. GS Metals Corp.
 - 5. Loos & Company, Inc.
 - 6. Mason Industries, Inc.
 - 7. Powerstrut.
 - 8. Thomas & Betts Corp.
 - 9. Unistrut Corporation.

2.2 MATERIALS

- A. Use the following materials for restraints:
 - 1. Indoor Dry Locations: Steel, zinc plated.
 - 2. Outdoors and Damp Locations: Galvanized steel.
 - 3. Corrosive Locations: Stainless steel.

2.3 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

- A. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to authorities having jurisdiction.
 - 1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.
- B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type.
 - 1. Concrete Inserts: Steel-channel type.

- C. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
- D. Welding Lugs: Comply with MSS SP-69, Type 57.
- E. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
- F. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
- G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.4 SEISMIC BRACING COMPONENTS

- A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch thick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.
 - 1. Materials for Channel: ASTM A 570, GR 33.
 - 2. Materials for Fittings and Accessories: ASTM A 575, ASTM A 576, or ASTM A 36.
 - 3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
 - 4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.
- B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.
- C. Cable-Type Bracing Assemblies: Zinc-coated, high-strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.
 - 1. Arrange units for attachment to the braced component at one end and to the structure at the other end.
 - 2. Wire Rope Cable: Comply with ASTM 603. Use 49- or 133-strand cable with a minimum strength of 2 times the calculated maximum seismic force to be resisted.
- D. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install seismic restraints according to applicable codes and regulations and as approved by authorities having jurisdiction, unless more stringent requirements are indicated.

3.2 STRUCTURAL ATTACHMENTS

- A. Use bolted connections with steel brackets, slotted channel, and slotted-channel fittings to spread structural loads and reduce stresses.
- B. Attachments to New Concrete: Bolt to channel-type concrete inserts or use expansion anchors.
- C. Attachments to Existing Concrete: Use expansion anchors.
- D. Holes for Expansion Anchors in Concrete: Drill at locations and to depths that avoid reinforcing bars.
- E. Attachments to Solid Concrete Masonry Unit Walls: Use expansion anchors.
- F. Attachments to Hollow Walls: Bolt to slotted steel channels fastened to wall with expansion anchors.
- G. Attachments to Wood Structural Members: Install bolts through members.
- H. Attachments to Steel: Bolt to clamps on flanges of beams or on upper truss chords of bar joists.

3.3 ELECTRICAL EQUIPMENT ANCHORAGE

- A. Anchor rigidly to a single mobile structural element or to a concrete base that is structurally tied to a single mobile structural element.
- B. Anchor panelboards, motor-control centers, motor controls, switchboards, switchgear, transformers, unit substations, fused power-circuit devices, transfer switches, busways, battery racks, static uninterruptible power units, power conditioners, capacitor units, communication system components, and electronic signal processing, control, and distribution units as follows:
 - 1. Size concrete bases so expansion anchors will be a minimum of 10 bolt diameters from the edge of the concrete base.
 - 2. Concrete Bases for Floor-Mounted Equipment: Use female expansion anchors and install studs and nuts after equipment is positioned.
 - 3. Bushings for Floor-Mounted Equipment Anchors: Install to allow for resilient media between anchor bolt or stud and mounting hole in concrete.

4. Anchor Bolt Bushing Assemblies for Wall-Mounted Equipment: Install to allow for resilient media where equipment or equipment-mounting channels are attached to wall.
5. Torque bolts and nuts on studs to values recommended by equipment manufacturer.

3.4 SEISMIC BRACING INSTALLATION

- A. Install bracing according to spacings and strengths indicated by approved analysis.
- B. Expansion and Contraction: Install to allow for thermal movement of braced components.
- C. Cable Braces: Install with maximum cable slack recommended by manufacturer.
- D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to the structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.5 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Make flexible connections in raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate at electrical equipment anchored to a different mobile structural element from the one supporting them.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform the following field quality-control testing:
- B. Testing Agency: Engage a qualified testing agency to perform the following field quality-control testing:
- C. Testing: Test pull-out resistance of seismic anchorage devices.
 1. Provide necessary test equipment required for reliable testing.
 2. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 3. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
 4. Obtain Architect's approval before transmitting test loads to the structure. Provide temporary load-spreading members.
 5. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 6. Test to 90 percent of rated proof load of device.

TR DESIGN GROUP
CONSTRUCTION DOCS

COUNTY OF SAN BERNARDINO
DEPARTMENT OF BEHAVIORAL HEALTH
CRISIS RESIDENTIAL TREATMENT FACILITY
SUNHILL DR. & HESPERIA RD., CA 92395
MAY 27, 2016

7. If a device fails the test, modify all installations of same type and retest until satisfactory results are achieved.
8. Record test results.

END OF SECTION 260533

NOT FOR BID

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Nameplates.
 - 2. Wire markers.
 - 3. Underground Warning Tape.

1.2 SUBMITTALS

- A. Product Data:
 - 1. Submit manufacturer's catalog literature for each product required.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept identification products on site in original containers. Inspect for damage.
- C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

PART 2 - PRODUCTS

2.1 NAMEPLATES

- A. Product Description: Laminated three-layer plastic with engraved white letters on black contrasting background color.
- B. Letter Size:
 - 1. 1/4 inch high letters for identifying individual equipment and loads.
 - 2. 1/2 inch high letters for identifying grouped equipment and loads.
 - 3. 3/8 inch high letters for identifying panelboards
- C. Minimum nameplate thickness: 1/8 inch.

2.2 WIRE MARKERS

- A. Description: Split sleeve type wire markers.

- B. Legend:
1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 EXISTING WORK

- A. Install identification on existing equipment to remain in accordance with this section.

3.3 INSTALLATION

- A. Install identifying devices after completion of painting.
- B. Nameplate Installation:
1. Install nameplate parallel to equipment lines.
 2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners.
 3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
 4. Secure nameplate to equipment front using screws.
 5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.
 6. Install nameplates for the following:
 - a. Switchboards.
 - b. Panelboards.
 - c. Service Disconnects.
 - d. Transformer
 - e. Lighting Control Panel
- C. Wire Marker Installation: Install wire marker for each conductor at panelboard gutters, pull boxes, outlet and junction boxes and each load connection.
- D. Underground Warning Tape Installation: Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Lighting relays and controllers.
 - 2. Lighting contactors.
 - 3. Switches.
 - 4. Switch plates.
 - 5. Occupancy sensors.
 - 6. Photocells.
 - 7. Photocell control unit.
- B. Related Sections:
 - 1. Section 260503 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.
 - 2. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.
 - 3. Section 260533 - Raceway and Boxes for Electrical Systems: Product requirements for raceway and boxes for placement by this section.
 - 4. Section 260553 - Identification for Electrical Systems: Product requirements for electrical identification items for placement by this section.
 - 5. Section 262416 - Panelboards.
 - 6. Section 262726 - Wiring Devices: Product requirements for wiring devices for placement by this section.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
 - 2. NEMA FU 1 - Low Voltage Cartridge Fuses.
 - 3. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contractors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
 - 4. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks.
 - 5. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
 - 6. NEMA ICS 6 - Industrial Control and Systems: Enclosures.
 - 7. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

1.3 SYSTEM DESCRIPTION

- A. Wired control system using self contained individually mounted lighting relays, controllers, network bridges, sensors and switches.

- B. Where indicated on drawings or required by applicable code, provide automatic shutoff for lighting inside building larger than 5000 square feet. Control shutoff by method conforming to ICC IECC.
- C. Where indicated on drawings or required by applicable code, provide automatic shutoff for lighting outside building. Control shutoff by method conforming to ICC IECC.

1.4 SUBMITTALS

- A. Division 01 – General Requirements: Requirements for submittals.
- B. Shop Drawings: Indicate dimensioned drawings of lighting control system components and accessories.
 - 1. One Line Diagram: Indicating system configuration indicating panels, number and type of switches or devices.
 - 2. Include typical wiring diagrams for each component.
- C. Product Data: Submit manufacturer's standard product data for each system component.
- D. Manufacturer's Installation Instructions: Submit for each system component.
- E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Requirements for submittals.
- B. Project Record Documents: Record the following information:
 - 1. Actual locations of components and record circuiting and switching arrangements.
 - 2. Wiring diagrams reflecting field installed conditions with identified and numbered, system components and devices.
- C. Operation and Maintenance Data:
 - 1. Submit replacement parts numbers.
 - 2. Submit manufacturer's published installation instructions and operating instructions.
 - 3. Recommended renewal parts list.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with State of California standards.
- B. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.8 PRE-INSTALLATION MEETINGS

- A. Division 01 – General Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept components on site in manufacturer's packaging. Inspect for damage.
- C. Protect components by storing in manufacturer's containers indoor protected from weather.

1.10 WARRANTY

- A. Division 01 – General Requirements: Requirements for warranties.
- B. Furnish five year manufacturer warranty for components.

1.11 EXTRA MATERIALS

- A. Division 01 – General Requirements: Requirements for extra materials.
- B. Furnish two of each switch type.
- C. Furnish two of each occupancy sensor type.
- D. Furnish two of each sensor type.
- E. Furnish two of each network bridge type.
- F. Furnish two of each dimming controller type.
- G. Furnish two of each room controller type.

PART 2 - PRODUCTS

2.1 REMOTE CONTROL LIGHTING RELAYS

- A. Manufacturers:

1. Automatic Switch Co.
 2. Cutler-Hammer.
 3. Square D Model.
 4. Substitutions: Not Permitted.
- B. Product Description: Heavy duty, single-coil momentary contact mechanically held remote control relays.
- C. Contacts: Rated 20 amperes at 120 volts. Rated for lighting applications quartz halogen, tungsten, fluorescent and LED lamps.
- D. Line Voltage Connections: Clamp type screw terminals.
- E. Enclosure: NEMA ICS 6, to meet conditions. Fabricate enclosure from [steel finished with manufacturer's standard gray enamel.
1. Interior Dry Locations: Type 1.
 2. Exterior Locations: Type 3R or 4SST.

2.2 LIGHTING CONTACTORS

- A. Manufacturers:
1. Automatic Switch Co.
 2. Cutler-Hammer.
 3. Square D.
 4. Substitutions: Not Permitted.
- B. Product Description: NEMA ICS 2, magnetic lighting contactor.
- C. Configuration: Electrically held, 2 or 3 wire control].
- D. Coil Operating Voltage: 120 volts, 60 Hertz.
- E. Poles: To match circuit configuration and control function.
- F. Contact Rating: Conductor overcurrent protection, considering derating for continuous loads.
- G. Accessories:
1. Cover Mounted Pilot Devices: NEMA ICS 5, heavy-duty oiltight type with Form Z contacts, rated A150.
 2. Pushbutton: ON/OFF function, with recessed, shrouded, covered and lockable configuration.
 3. Selector Switch: ON/OFF/AUTOMATIC function, with rotary action.
 4. Indicating Light: Green lens, transformer type, with led lamp.
 5. Auxiliary Contacts: One, normally open and normally closed field convertible in addition to seal-in contact.
 6. Relays: NEMA ICS 2.

7. Control Power Transformers: 120 volt secondary, 50 VA minimum, in each enclosed contactor. Furnish fused primary and secondary, and bond unfused leg of secondary to enclosure.
- H. Enclosure: NEMA ICS 6, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
 1. Interior Dry Locations: Type 1.
 2. Exterior Locations: Type 3R or 4SST.

2.3 LINE VOLTAGE SWITCHES

- A. Manufacturers:
 1. Hubbell Incorporated.
 2. Leviton Manufacturing Co., Inc.
 3. Pass and Seymour/Legrand.
 4. Substitutions: Not Permitted.
- B. Wall Switch: Specification Grade unlighted, momentary pushbutton type for overriding relays.
 1. Material: Stainless steel.
 2. Color: Ivory or White.
- C. Key Switch: Spade key type. Match non-key switch ratings.
- D. Switches with Pilot Lamp: Momentary contact, three position rocker type, ivory color, rated 3 amperes at 25 VAC, with integral red pilot light.

2.4 SWITCH PLATES

- A. Manufacturers:
 1. Hubbell Incorporated.
 2. Leviton Manufacturing Co., Inc.
 3. Pass and Seymour/Legrand.
 4. Substitutions: Not Permitted.
- B. Product Description: Specification Grade.
 1. Material: Stainless steel.

2.5 NETWORKED COMPONENTS PER DRAWINGS

- A. Manufacturers:
 1. Watt Stopper.
 2. Crestron.
 3. Lutron.
 4. Approved equal.
- B. Compatible with modular relay panels. Capable of being wired directly to Class 2 wiring without auxiliary components or devices.

- C. Separate sensitivity and time delay adjustments with LED indication of sensed movement. User adjustable time-delay: 30 seconds to 12 minutes.
- D. Furnish with manual override.
- E. Operation: Silent.
- F. Room Sensors: As indicated on Drawings.
- G. Corridor and Hallway Sensors:
 - 1. Capable of detecting motion 14 feet wide and 80 feet long with one sensor mounted 10 feet above floor.
 - 2. Capable of detecting motion in warehouse aisle 10 feet wide and 60 feet long or 100 feet long when mounted 22 feet above floor.
 - 3. Capable of being wired in master-slave configuration to extend area of coverage.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Mount switches, occupancy sensors, photocells and all control devices as indicated on Drawings.
- B. Install wiring in accordance with Section 260519.
- C. Use only properly color coded, stranded wire. Install wire sizes as indicated on Drawings. Install wire in conduit in accordance with Section 260533.
- D. Label each low voltage wire clearly indicating connecting terminals. Refer to Section 260553.
- E. Identify power wiring with circuit breaker number controlling load. When multiple circuit breaker panels are feeding into relay panel, label wires to indicate originating panel designation.

3.2 MANUFACTURER'S FIELD SERVICES

- A. Division 01 – General Requirements: Requirements for manufacturer's field services.
- B. Furnish services for minimum of one day for check, test, and start-up. Perform the following services:
 - 1. Check installation of panelboards.
 - 2. Test operation of remote controlled devices.
 - 3. Repair or replace defective components.

3.3 ADJUSTING

- A. Division 01 – General Requirements: Requirements for starting and adjusting.
- B. Test each system component after installation to verify proper operation.
- C. Test all components after installation to confirm proper operation.
- D. Confirm correct loads are recorded on directory card in each panel.

3.4 DEMONSTRATION

- A. Division 01 – General Requirements: Requirements for demonstration and training.
- B. Demonstrate operation of the following system components:
 - 1. Operation of switches. Demonstrate for zones.
 - 2. Operation of each type of occupancy sensors. Demonstrate for zones.
 - 3. Operation of each type of photocell. Demonstrate for zones.
- C. Furnish 8 hours to instruct Owner's personnel in operation and maintenance of system. Schedule training with Owner, provide at least 7 days notice to Architect/Engineer of training date.

END OF SECTION 260923

NOT FOR BID

SECTION 262413 - SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes distribution switchboards.
- B. Related Sections:
 - 1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 2. Section 26 05 53 - Identification for Electrical Systems.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI C12.1 - Code for Electricity Metering.
 - 2. ANSI C39.1 - Requirements, Electrical Analog Indicating Instruments.
- B. Institute of Electrical and Electronics Engineers:
 - 1. IEEE C57.13 - Standard Requirements for Instrument Transformers.
 - 2. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
- C. National Electrical Manufacturers Association:
 - 1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
 - 2. NEMA FU 1 - Low Voltage Cartridge Fuses.
 - 3. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
 - 4. NEMA PB 2 - Deadfront Distribution Switchboards.
 - 5. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less.
- D. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Shop Drawings: Indicate front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars for each phase, neutral, and ground; and switchboard instrument details.

- C. Product Data: Submit electrical characteristics including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of equipment and components.
- D. Test Reports: Indicate results of factory production and field tests.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations, configurations, and ratings of switchboards and their components on single line diagrams and plan layouts.
- C. Operation and Maintenance Data: Submit spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Deliver in 48 inch maximum width shipping splits, individually wrapped for protection and mounted on shipping skids.
- C. Accept switchboards on site. Inspect for damage.
- D. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic.
- E. Handle in accordance with NEMA PB 2.1. Lift only with lugs provided. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 – General Requirements.
- B. Conform to NEMA PB 2 service conditions during and after installation of switchboards.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 SEQUENCING

- A. Division 01 – General Requirements: Work sequence.
- B. Sequence Work to avoid interferences with building finishes and installation of other products.

1.10 MAINTENANCE MATERIALS

- A. Division 01 – General Requirements: Spare parts and maintenance products.
- B. Furnish two of each key.

PART 2 - PRODUCTS

2.1 DISTRIBUTION SWITCHBOARDS

- A. Manufacturers:
 - 1. Eaton.
 - 2. General Electric.
 - 3. Square D.
 - 4. ITE Siemens.
 - 5. Substitutions: Division 01 – General Requirements - Product Requirements.
- B. Product Description: NEMA PB 2, enclosed switchboard with electrical ratings and configurations as indicated on Drawings.
- C. Device Mounting:
 - 1. Main Section: Individually mounted and compartmented.
 - 2. Distribution Section: Individually mounted and compartmented.
 - 3. Auxiliary Section: Individually mounted and compartmented.
- D. Bus:
 - 1. Material: Copper with tin plating, standard size.
 - 2. Connections: Bolted, accessible from front for maintenance.
 - 3. Insulation: Fully insulate bus bars. Do not reduce spacing of insulated bus.
- E. Ground Bus: Insulated, extend length of switchboard.
- F. Line and Load Terminations: Accessible from front only of switchboard, suitable for conductor materials and sizes as indicated on Drawings.
- G. Pull Section: Size as indicated on Drawings to side.

- H. Future Provisions: Fully equip spaces for future devices with bussing and bus connections, insulated and braced for short circuit currents. Furnish continuous current rating as indicated on Drawings.
- I. Enclosure: Type 1 - General Purpose for interior – Type 3R – Weather proof for exterior.
- J. Align sections at front and rear.
- K. Finish: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.

2.2 MOLDED CASE CIRCUIT BREAKER

- A. Manufacturers:
 - 1. Eaton.
 - 2. ITE Siemens.
 - 3. Square D.
 - 4. General Electric.
 - 5. Substitutions: Division 01 – General Requirements - Product Requirements.
- B. Product Description: NEMA AB 1, molded-case circuit breaker.
- C. Field-Adjustable Trip Circuit Breaker: Circuit breakers with frame sizes 400 amperes and larger have mechanism for adjusting long time short time continuous current setting for automatic operation.
- D. Field-Changeable Ampere Rating Circuit Breaker: Circuit breakers with frame sizes 400 amperes and larger have changeable trip units.
- E. Current Limiting Circuit Breaker: Circuit breaker indicated as current-limiting have automatically-resetting current limiting elements in each pole. Let-through Current and Energy: Less than permitted for same size Class RK-5 fuse.
- F. Solid-State Circuit Breaker: Electronic sensing, timing, and tripping circuits for adjustable current settings; ground fault trip with integral ground fault sensing/zero sequence type ground fault, sensor; instantaneous trip; and adjustable short time trip.
- G. Current Limiter: Designed for application with molded case circuit breaker.
 - 1. Coordinate limiter size with trip rating of circuit breaker to prevent nuisance tripping and to achieve interrupting current rating specified for circuit breaker.
 - 2. Interlocks trip circuit breaker and prevent closing circuit breaker when limiter compartment cover is removed or when one or more limiter is not in place or has operated.

- H. Accessories: As indicated on Drawings. Conform to NEMA AB 1.
 - 1. Shunt Trip Device: 120 volts, AC.
 - 2. Undervoltage Trip Device: 120 volts, AC.
 - 3. Auxiliary Switch: 120 volts, AC.
 - 4. Alarm Switch: 120 volts, AC.
 - 5. Electrical Operator: 120 volts, AC.
 - 6. Handle Lock: Provisions for padlocking.
 - 7. Insulated Grounding Lug: In each enclosure.
- I. Terminal Lugs Size: NEMA AB1. Suitable for copper conductors as indicated on drawings. Oversize to accommodate oversized feeders as indicated on the drawings.
- J. Provide circuit breakers, UL listed, as Tpe HACR for heating, air conditioning and refrigeration branch circuits.

2.3 INSULATED CASE CIRCUIT BREAKER

- A. Manufacturers:
 - 1. Eaton.
 - 2. ITE Siemens.
 - 3. Square D.
 - 4. General Electric.
 - 5. Substitutions: Division 01 — General Requirements - Product Requirements.
- B. Product Description: NEMA AB 1, enclosed, insulated-case circuit breaker.
- C. Trip Unit: Electronic sensing, timing, and tripping circuits for adjustable current settings; ground fault trip with integral ground fault sensing as indicated on the drawings; instantaneous trip; and adjustable short time trip.
- D. Accessories: As indicated on Drawings. Conform to NEMA AB 1.
 - 1. Shunt Trip Device: 120 volts, AC.
 - 2. Undervoltage Trip Device: 120 volts, AC.
 - 3. Auxiliary Switch: 120 volts, AC.
 - 4. Alarm Switch: 120 volts, AC.
 - 5. Electrical Operator: 120 volts, AC.
 - 6. Handle Lock: Provisions for padlocking.
 - 7. Insulated Grounding Lug: In each enclosure.

2.4 TRANSIENT VOLTAGE SUPPRESSION DEVICES

- A. Manufacturers:
 - 1. Eaton.
 - 2. ITE Siemens.
 - 3. Square D.
 - 4. General Electric.

5. Substitutions: Division 01 – General Requirements - Product Requirements.

B. Product Description: IEEE C62.41, factory-mounted transient voltage surge suppressor, selected to meet requirements for low medium and high exposure and to coordinate with system circuit voltage.

2.5 SOURCE QUALITY CONTROL

- A. Furnish shop inspection and testing in accordance with NEMA PB 2.
- B. Make completed switchboard available for inspection at manufacturer's factory prior to packaging for shipment. Notify Architect/Engineer at least seven days before inspection is allowed.
- C. Allow witnessing of factory inspections and tests at manufacturer's test facility. Notify Architect/Engineer at least seven days before inspections and tests are scheduled.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Coordination and project conditions.
- B. Verify surface is suitable for switchboard installation.

3.2 INSTALLATION

- A. Install in accordance with NEMA PB 2.1.
- B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.
- C. Install fuses in each switch and coordinate sizes with connected load.
- D. Install engraved plastic nameplates in accordance with Section 26 05 53.
- E. Install breaker circuit directory.
- F. Ground and bond switchboards in accordance with Section 26 05 26.

3.3 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.

- C. Perform inspections and tests listed in NETA ATS, Section 7.1.

3.4 ADJUSTING

- A. Division 01 – General Requirements: Testing, adjusting, and balancing.
- B. Adjust operating mechanisms for free mechanical movement.
- C. Tighten bolted bus connections.
- D. Adjust circuit breaker trip and time delay settings to values as indicated by short circuit and over current protective device coordination study.

3.5 CLEANING

- A. Division 01 – General Requirements: Final cleaning.
- B. Touch up scratched or marred surfaces to match original finish.

END OF SECTION 262413

NOT FOR BID

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Distribution and branch circuit panelboards.
- B. Related Sections:
 - 1. Section 260526 - Grounding and Bonding for Electrical Systems.
 - 2. Section 260553 - Identification for Electrical Systems.
 - 3. Section 262813 - Fuses.

1.2 REFERENCE STANDARDS

- A. Institute of Electrical and Electronics Engineers:
 - 1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
- B. National Electrical Manufacturers Association:
 - 1. NEMA FU 1 - Low Voltage Cartridge Fuses.
 - 2. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
 - 3. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
 - 4. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
 - 5. NEMA PB 1 - Panelboards.
 - 6. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
 - 7. NEMA A1 - Molded Case Circuit Breakers and Molded Case Switches.
- C. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- D. National Fire Protection Association:
 - 1. CEC - California Electrical Code.
- E. Underwriters Laboratories Inc.:
 - 1. UL 50 - Cabinets and Boxes
 - 2. UL 67 - Safety for Panelboards.
 - 3. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
 - 4. UL 1283 - Electromagnetic Interference Filters.
 - 5. UL 1449 - Transient Voltage Surge Suppressors.

6. UL 1699 - Arc-Fault Circuit Interrupters.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Requirements for submittals.
- B. Product Data: Submit catalog data showing specified features of standard products.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- D. Field Quality Control Submittals: Indicate results of Contractor furnished tests and inspections.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.
- C. Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Division 01 – General Requirements: Requirements for maintenance products.
- B. Extra Stock Materials:
 - 1. Furnish two of each panelboard key. Panelboards keyed alike.

1.6 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.1 DISTRIBUTION PANELBOARDS

- A. Manufacturers:
 - 1. Eaton as basis of design.
 - 2. General Electric.
 - 3. Square D.

PANELBOARDS

4. Siemens.
 5. Substitutions: Division 01 – General Requirements - Product Requirements.
- B. Description: NEMA PB 1, circuit breaker type panelboard.
- C. Operation:
1. Minimum integrated short circuit rating: 22,000 amperes rms symmetrical for 208 volt panelboards; 65,000 amperes rms symmetrical for 480 volt panelboards, or as indicated on Drawings.
- D. Materials
1. Panelboard Bus: Copper, tin or silver plated, current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.
 2. Fusible Switch Assemblies: NEMA KS 1, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Furnish interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.
 3. Molded Case Circuit Breakers: UL 489, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Furnish circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
 4. Molded Case Circuit Breakers with Current Limiters: UL 489, circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.
 5. Current Limiting Molded Case Circuit Breakers: UL 489, circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size NEMA FU 1, Class RK-5 fuse.

2.2 BRANCH CIRCUIT PANELBOARDS

- A. Manufacturer List:
1. Eaton as basis if design.
 2. Square D.
 3. General Electric.
 4. Siemens.
 5. Substitutions: Division 01 – General Requirements - Product Requirements.
- B. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.
- C. Materials:

1. Panelboard Bus: Copper, current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.
 2. Minimum Integrated Short Circuit Rating: 22,000 amperes rms symmetrical for 208 volt panelboards; 65,000 amperes rms symmetrical for 480 volt panelboards, or as indicated on Drawings.
 3. Molded Case Circuit Breakers: UL 489, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers as indicated on Drawings. Provide UL class 760 arc-fault interrupter circuit breakers as indicated on Drawings. Do not use tandem circuit breakers.
 4. Enclosure: NEMA PB 1, Type 1 or Type 3R.
 5. Cabinet Box: 6 inches deep, 20 inches wide.
- D. Cabinet Front: Flush or surface cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock keyed alike. Finish in manufacturer's standard gray enamel.

2.3 SOURCE QUALITY CONTROL

- A. Division 01 – General Requirements: Testing, inspection and analysis requirements.
- B. Independently test integral surge suppressers with category C3 high exposure waveform (20 kV-1.2/50us, 10kA-8/20 us) per IEEE C62.41.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1.
- B. Install panelboards plumb.
- C. Install recessed panelboards flush with wall finishes.
- D. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.
- E. Install filler plates for unused spaces in panelboards.
- F. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes to balance phase loads.
- G. Install engraved plastic nameplates in accordance with Section 260553.

- H. Install spare conduits out of each recessed panelboard to accessible location above ceiling. Minimum spare conduits: 5 empty $\frac{3}{4}$ inch. Identify each as SPARE.
- I. Ground and bond panelboard enclosure according to Section 260526. Connect equipment ground bars of panels in accordance with NFPA 70.

3.2 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Requirements for testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.
- D. Perform switch inspections and tests listed in NETA ATS, Section 7.5.
- E. Perform controller inspections and tests listed in NETA ATS, Section 7.16.1.

3.3 ADJUSTING

- A. Division 01 – General Requirements: Requirements for starting and adjusting.
- B. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

3.4 CLEANING

- A. Division 01 – General Requirements: Requirements for cleaning.

END OF SECTION 262416

NOT FOR BID

SECTION 262716 - ELECTRICAL CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Hinged cover enclosures.
 - 2. Cabinets.
 - 3. Terminal blocks.
 - 4. Accessories.
- B. Related Requirements:
 - 1. Section 260526 - Grounding and Bonding for Electrical Systems.
 - 2. Section 260529 - Hangers and Supports for Electrical Systems.
 - 3. Section 260533 - Raceway and Boxes for Electrical Systems.
 - 4. Section 270533 - Conduits and Backboxes for Communications Systems.

1.2 REFERENCE STANDARDS

- A. National Electrical Manufacturers Association:
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Product Data: Submit manufacturer's standard data for enclosures, cabinets, and terminal blocks.
- C. Manufacturer's Instructions: Submit application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Division 01 – General Requirements: Requirements for maintenance materials.
- B. Extra Stock Materials:
 - 1. Furnish two of each key.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.1 HINGED COVER ENCLOSURES

- A. Manufacturer List:
 - 1. Cooper B-Line.
 - 2. Carlon Electrical Products.
 - 3. Hoffman Engineering Company.
 - 4. Hubbell Wiring Devices.
- B. Substitution Limitations:
 - 1. Division 01 – General Requirements: Requirements for substitutions for other manufacturers and products.
- C. Description: NEMA 250, Type 1 or 4 steel galvanized steel enclosure.
 - 1. Covers: Continuous hinge, held closed by flush latch operable by key.
 - 2. Furnish interior plywood panel for mounting terminal blocks and electrical components; finish with white enamel.
 - 3. Enclosure Finish: Manufacturer's standard enamel.

2.2 CABINETS

- A. Manufacturer List:
 - 1. Cooper B-Line.
 - 2. Carlon Electrical Products.
 - 3. Hoffman Engineering Company
 - 4. Hubbell Wiring Devices.
- B. Substitution Limitations:
 - 1. Division 01 – General Requirements: Requirements for substitutions for other manufacturers and products.
- C. Description:
 - 1. Boxes: Galvanized steel.
 - 2. Box Size: as noted on drawings.
 - 3. Backboard: Furnish 3/4 inch thick plywood backboard for mounting terminal blocks. Paint matte white.
 - 4. Fronts: Steel, flush or surface type with door with concealed hinge, and flush lock.
 - 5. Knockouts: None.
- D. Fabrication
 - 1. Furnish metal barriers to form separate compartments wiring of different systems and voltages.
 - 2. Furnish accessory feet for free-standing equipment.
- E. Finishes:
 - 1. Finish with gray baked enamel.

2.3 TERMINAL BLOCKS

- A. Manufacturer List:
 - 1. Entrelec Inc.
 - 2. Phoenix Contact.
 - 3. Weidmuller.
- B. Substitution Limitations:
 - 1. Division 01 – General Requirements: Requirements for substitutions for other manufacturers and products.
- C. Description:
 - 1. Terminal Blocks: NEMA ICS 4.
 - 2. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
 - 3. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
 - 4. Furnish ground bus terminal block, with each connector bonded to enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner in accordance with Section 260529.
- B. Install cabinet fronts plumb.

3.2 CLEANING

- A. Division 01 – General Requirements: Final cleaning.
- B. Clean electrical parts to remove conductive and harmful materials.
- C. Remove dirt and debris from enclosure.
- D. Clean finishes and touch up damage.

END OF SECTION 262716

NOT FOR BID

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes wall switches; wall dimmers; receptacles; multi-outlet assembly; and device plates and decorative box covers.
- B. Related Sections:
 - 1. Section 260533 - Raceway and Boxes for Electrical Systems: Outlet boxes for wiring devices.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA WD 1 - General Requirements for Wiring Devices.
 - 2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.5 EXTRA MATERIALS

- A. Furnish two (2) of each style, size, and finish wall plate.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

- A. Manufacturers:
 - 1. Leviton.
 - 2. Pass & Seymour.
 - 3. Wattstopper.
 - 4. Hubbell.
- B. Product Description: NEMA WD 1, Heavy-Duty, AC only general-use decora switch.
- C. Body and Handle: White plastic with rocker handle.

- D. Ratings:
 - 1. Voltage: 120 or 277 volts, AC.
 - 2. Current: 20 amperes.

2.2 RECEPTACLES

- A. Duplex Convenience Receptacle:
 - 1. Bryant.
 - 2. Leviton.
 - 3. Pass & Seymour.
 - 4. Hubbell.
- B. GFCI Receptacle:
 - 1. Bryant.
 - 2. Leviton.
 - 3. Pass & Seymour.
 - 4. Hubbell.
- C. Product Description: NEMA WD 1, Heavy-duty general use receptacle.
- D. Device Body: White plastic.
- E. Configuration: NEMA WD 6, type as indicated on Drawings.
- F. Convenience Receptacle: Type 5-20.
- G. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.3 WALL PLATES

- A. Manufacturers:
 - 1. Arrow Hart Wiring Devices.
 - 2. Bryant.
 - 3. Leviton.
 - 4. Pass & Seymour.
 - 5. Hubbell.
- B. Decorative Cover Plate: White nylon.
- C. Weatherproof Cover Plate: Gasketed cast metal plate with hinged and gasketed device cover.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify outlet boxes are installed at proper height.

WIRING DEVICES

- B. Verify wall openings are neatly cut and completely covered by wall plates.
- C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

- A. Clean debris from outlet boxes.

3.3 EXISTING WORK

- A. Disconnect and remove abandoned wiring devices.
- B. Modify installation to maintain access to existing wiring devices to remain active.
- C. Clean and repair existing wiring devices to remain or to be reinstalled.

3.4 INSTALLATION

- A. Install devices plumb and level.
- B. Install switches with OFF position down.
- C. Install receptacles with grounding pole on top.
- D. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.
- E. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- F. Connect wiring devices by wrapping solid conductor around screw terminal.
- G. Use jumbo size plates for outlets installed in masonry walls.
- H. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.5 INTERFACE WITH OTHER PRODUCTS

- A. Install wall switch 48 inches above finished floor to top of outlet box.
- B. Install convenience receptacle 18 inches above finished floor to bottom of box or as indicated on the drawings.
- C. Install convenience receptacle 6 inches horizontally above counter or back splash of counter.
- D. Install dimmer 48 inches above finished floor.

3.6 FIELD QUALITY CONTROL

- A. Inspect each wiring device for defects.
- B. Operate each wall switch with circuit energized and verify proper operation.
- C. Verify each receptacle device is energized.
- D. Test each receptacle device for proper polarity.
- E. Test each GFCI receptacle device for proper operation.

3.7 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.8 CLEANING

- A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fuses.
 - 2. Spare fuse cabinet.

1.2 REFERENCE STANDARDS

- A. National Electrical Manufacturers Association:
 - 1. NEMA FU 1 - Low Voltage Cartridge Fuses.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Product Data: Submit data sheets showing electrical characteristics, including time-current curves.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Closeout procedures.
- B. Project Record Documents: Record actual sizes, ratings, and locations of fuses.

1.5 MAINTENANCE MATERIALS

- A. Division 01 – General Requirements: Requirements for maintenance materials
- B. Spare Parts:
 - 1. Furnish two fuse pullers.
- C. Extra Materials:
 - 1. Furnish three spare fuses of each Class, size, and rating installed.

1.6 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer List:
 - 1. Gould Shaw Mut.
 - 2. Bussman.
 - 3. Reliance.
- B. Substitution Limitations:
 - 1. Division 01 – General Requirements: Requirements for substitutions for other manufacturers and products.

2.2 FUSES

- A. Dimensions and Performance: NEMA FU 1, Class as specified or as indicated on Drawings.
- B. Voltage: Rating suitable for circuit phase-to-phase voltage.

2.3 SPARE FUSE CABINET

- A. Description: Wall-mounted sheet metal cabinet with shelves, suitably sized to store spare fuses and fuse pullers specified.
 - 1. Doors: Hinged, with hasp for Owner's padlock.
- B. Finish:
 - 1. Gray enamel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fuse with label oriented so manufacturer, type, and size are easily read.
- B. Install spare fuse cabinet as indicated on Drawings.

END OF SECTION 262813

SECTION 262819 - ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fusible.
 - 2. Nonfusible switches.
- B. Related Sections:
 - 1. Section 260529 - Hangers and Supports for Electrical Systems.
 - 2. Section 260553 - Identification for Electrical Systems.
 - 3. Section 262813 - Fuses.

1.2 REFERENCE STANDARDS

- A. National Electrical Manufacturers Association:
 - 1. NEMA FU 1 - Low Voltage Cartridge Fuses.
 - 2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- B. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Product Data: Submit switch ratings and enclosure dimensions.

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of enclosed switches and ratings of installed fuses.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCH ASSEMBLIES

- A. Manufacturers:
 - 1. Square D.
 - 2. Eaton.
 - 3. General Electric.
 - 4. Substitutions: Division 01 – General Requirements – Product Requirements.
- B. Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Handle lockable in OFF position.
- C. Fuse clips: Designed to accommodate NEMA FU 1, Class R fuses.
- D. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
 - 1. Interior Dry Locations: Type 1.
 - 2. Exterior Locations: Type 3R.
- E. Furnish switches with entirely copper current carrying parts.

2.2 NONFUSIBLE SWITCH ASSEMBLIES

- A. Manufacturers:
 - 1. Square D.
 - 2. Eaton.
 - 3. General Electric.
 - 4. Substitutions: Division 01 – General Requirements – Product Requirements.
- B. Description: NEMA KS 1, Type HD with externally operable handle interlocked to prevent opening front cover with switch in ON position enclosed load interrupter knife switch. Handle lockable in OFF position.
- C. Materials:
 - 1. Enclosure: NEMA KS 1, to meet conditions. Fabricate enclosure from steel finished with manufacturer's standard gray enamel.
 - a. Interior Dry Locations: Type 1.
 - b. Exterior Locations: Type 3R.
- D. Furnish switches with entirely copper current carrying parts.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install enclosed switches where indicated.
- B. Install enclosed switches plumb. Provide supports in accordance with Section 260529.
- C. Height: 5 feet to operating handle.
- D. Install fuses for fusible disconnect switches. Refer to Section 262813 for product requirements.
- E. Install engraved plastic nameplates in accordance with Section 260553. Engrave nameplates with the equipment served and the panel and circuit number supplying the switch.
- F. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.2 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Requirements for inspecting, testing, adjusting, and balancing.
- B. Division 01 – General Requirements: Requirements for testing, adjusting, and balancing.
- C. Inspect and test in accordance with NETA ATS, except Section 4.
- D. Perform inspections and tests listed in NETA ATS, Section 7.5.

3.3 CLEANING

- A. Division 01 – General Requirements: Requirements for cleaning.

END OF SECTION 262819

NOT FOR BID

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes interior luminaires, lamps, ballasts, and accessories.
- B. Related Sections:
 - 1. Section 260526 - Grounding and Bonding for Electrical Systems.
 - 2. Section 260533 - Raceway and Boxes for Electrical Systems.
 - 3. Section 265200 - Emergency Lighting.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI C82.1 - American National Standard for Lamp Ballast-Line Frequency Fluorescent Lamp Ballast.

1.3 SUBMITTALS

- A. Division 1 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate dimensions and components for each luminaire not standard product of manufacturer.
- C. Product Data: Submit dimensions, ratings, and performance data.
- D. Samples: Submit two color chips 3 x 3 inch in size illustrating luminaire finish color where indicated in luminaire schedule.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years experience.

1.5 MOCK-UP

- A. Locate where indicated on Drawings.

1.6 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.7 MAINTENANCE MATERIALS

- A. Furnish two of each plastic lens type.

- B. Furnish one replacement lamps for every 2 lamps installed.
- C. Furnish two of each ballast type.

PART 2 - PRODUCTS

2.1 INTERIOR LUMINAIRES

- A. Product Description: Complete interior LED, fluorescent, and incandescent luminaire assemblies, with features, options, and accessories as indicated in lighting fixture schedule.

2.2 FLUORESCENT BALLASTS

- A. Product Description: Electronic ballast less than 10 percent THD, suitable for lamps specified, with voltage to match luminaire voltage.

2.3 FLUORESCENT LAMPS

- A. Manufacturers:
 - 1. General Electric Co.
 - 2. Phillips.
 - 3. Sylvania.
 - 4. Substitutions: Not Permitted.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install suspended luminaires using pendants supported from swivel hangers. Install pendant length required to suspend luminaire at indicated height.
- B. Support luminaires larger than 2 x 4 foot size independent of ceiling framing.
- C. Locate recessed ceiling luminaires as indicated on Drawings.
- D. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- E. Install recessed luminaires to permit removal from below.
- F. Install clips to secure recessed grid-supported luminaires in place.
- G. Install wall-mounted luminaires at height as indicated on Drawings.
- H. Install accessories furnished with each luminaire.

- I. Connect luminaires to branch circuit outlets provided under Section 260533 using flexible conduit.
- J. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- K. Install specified lamps and emergency components where applicable in each luminaire.
- L. Ground and bond interior luminaires in accordance with Section 260526.

3.2 FIELD QUALITY CONTROL

- A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

- A. Aim and adjust luminaires.

3.4 CLEANING

- A. Remove dirt and debris from enclosures.
- B. Clean photometric control surfaces as recommended by manufacturer.
- C. Clean finishes and touch up damage.

3.5 PROTECTION OF FINISHED WORK

- A. At Substantial Completion, replace all failed lamps, ballasts, and drivers, etc.

END OF SECTION 265100

NOT FOR BID

SECTION 265200 - EMERGENCY LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes emergency lighting units and exit signs.
- B. Related Sections:
 - 1. Section 260526 - Grounding and Bonding for Electrical Systems.
 - 2. Section 260533 - Raceway and Boxes for Electrical Systems.
 - 3. Section 265100 - Interior Lighting: Exit signs.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SYSTEM DESCRIPTION

- A. Emergency lighting to comply with CBC 1006.2 and 1006.3 requirements.

1.4 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Product Data: Submit dimensions, ratings, and performance data.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

1.6 MAINTENANCE MATERIALS

- A. Division 01 – General Requirements: Spare parts and maintenance products.
- B. Furnish 12 replacement lamps for each lamp installed.
- C. Furnish six replacement batteries for each battery type and size.

PART 2 - PRODUCTS

2.1 EMERGENCY LIGHTING UNITS

- A. Products: As shown on schedule on drawings.
 - 1. Substitutions: Division 01 – General Requirements - Product Requirements.

- B. Product Description: Self-contained emergency lighting unit.
- C. Battery: 12 volt, nickel-cadmium type, with 1.5 hour capacity.
- D. Battery Charger: Dual-rate type, with sufficient capacity to recharge discharged battery to full charge within twelve hours.
- E. Lamps: LED.

2.2 EXIT SIGNS

- A. Products: As shown on schedule on drawings.
 - 1. Substitutions: Division 01 – General Requirements – Product Requirements.
- B. Product Description: Exit sign fixture with integral 90 minute battery backup.
- C. Face: plastic face with green letters on white background
- D. Directional Arrows: Universal type for field adjustment.
- E. Mounting: Universal, for field selection.
- F. Battery: 12 volt, nickel-cadmium type, with 1.5 hour capacity.
- G. Battery Charger: Dual-rate type, with sufficient capacity to recharge discharged battery to full charge within twelve hours.
- H. Lamps: LED, 5 W per side, maximum.
- I. Input Voltage: As shown on schedule on drawings.

2.3 FLUORESCENT LAMP EMERGENCY POWER SUPPLY

- 1. Bodine.
- 2. Substitutions: Division 01 – General Requirements – Product Requirements.
- B. Product Description: Emergency battery power supply suitable for installation in ballast compartment of fluorescent luminaire.
- C. Lamp Ratings: One lamp providing 1100 lumens, minimum.
- D. Battery: Sealed lead calcium type, rated for 10 year life.
- E. Include TEST switch and AC ON indicator light, installed to be operable and visible from outside of assembled luminaire.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install suspended exit signs using pendants supported from swivel hangers. Install pendant length required to suspend sign at indicated height.
- B. Install surface-mounted emergency lighting units and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- C. Install wall-mounted emergency lighting units and exit signs at height as indicated on Drawings.
- D. Install accessories furnished with each emergency lighting unit and exit sign.
- E. Connect emergency lighting units and exit signs to branch circuit as indicated on Drawings.
- F. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within unit.
- G. Install specified lamps in each emergency lighting unit and exit sign.
- H. Ground and bond emergency lighting units and exit signs in accordance with Section 260526.

3.2 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Operate each unit after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

- A. Division 01 – General Requirements: Testing, adjusting, and balancing.
- B. Aim and adjust lamp fixtures as indicated on Drawings.
- C. Position exit sign directional arrows as indicated on Drawings.

3.4 PROTECTION OF FINISHED WORK

- A. Division 01 – General Requirements: Protecting finished work.

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CRISIS RESIDENTIAL TREATMENT FACILITY
SUNHILL DR. & HESPERIA RD., CA 92395
MAY 27, 2016

- B. Replace lamps, ballasts, drivers, etc. of emergency lighting units and exit signs which fail at Substantial Completion.

END OF SECTION 265200

SECTION 265600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes exterior luminaries and accessories.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI C82.1 - American National Standard for Lamp Ballast-Line Frequency Fluorescent Lamp Ballast.
 - 2. ANSI C82.4 - American National Standard for Ballasts-for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).

1.3 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Shop Drawings: Indicate dimensions and components for each luminaire not standard Product of manufacturer.
- C. Product Data: Submit dimensions, ratings, and performance data.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Product storage and handling requirements.

1.6 COORDINATION

- A. Division 01 – General Requirements: Coordination and project conditions.

1.7 MAINTENANCE MATERIALS

- A. Division 01 – General Requirements: Spare parts and maintenance products.
- B. Furnish 12 of each lamp, LED, and driver type installed.

PART 2 - PRODUCTS

2.1 LUMINAIRES

- A. Product Description: Complete exterior luminaire assemblies, with features, options, and accessories as scheduled.
- B. Refer to Division 01 – General Requirements for product options.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Coordination and Project conditions.

3.2 INSTALLATION

- A. Install fixtures plumb to adjust plumb. Grout around rear of fixtures at perimeter abutting the wall surface.
- B. Install lamps and emergency components where applicable in each luminaire.
- C. Bond and ground luminaries, metal accessories and metal poles in accordance with Section 260526.

3.3 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Operate each luminaire after installation and connection. Inspect for improper connections and operation.
- C. Measure illumination levels to verify conformance with performance requirements.
- D. Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

3.4 ADJUSTING

- A. Division 01 – General Requirements: Testing, adjusting, and balancing.
- B. Aim and adjust luminaries to provide illumination levels and distribution as indicated on Drawings.

3.5 CLEANING

- A. Division 01 – General Requirements: Final cleaning.

- B. Clean photometric control surfaces as recommended by manufacturer.
- C. Clean finishes and touch up damage.

3.6 PROTECTION OF FINISHED WORK

- A. Division 01 – General Requirements: Protecting finished work.
- B. Replace lamps, ballasts drivers, etc. of luminaries having failed at Substantial Completion.

END OF SECTION 265600

NOT FOR BID

SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wire.
 - 2. Mechanical connectors.
 - 3. Exothermic connections.
- B. Related Sections:
 - 1. Section 260526 - Grounding and Bonding for Electrical Systems.

1.2 REFERENCES

- A. Building Industry Consulting Service International, Inc.
 - 1. BICSI TDM Manual - Telecommunications Distribution Methods Manual.
- B. National Fire Protection Association:
 - 1. NFPA 70 - National Electrical Code.
- C. Telecommunication Industry Association/Electronic Industries Alliance:
 - 1. TIA/EIA 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications.

1.3 SYSTEM DESCRIPTION

- A. Communications grounding systems use the following elements as grounding electrodes:
 - 1. Building grounding electrode.
- B. Do not use the following elements as grounding electrodes:
 - 1. Building plumbing system.

1.4 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 25 ohms maximum.

1.5 SUBMITTALS

- A. Division 01 – General Requirements: Requirements for submittals.
- B. Product Data: Submit data on grounding electrodes and connections.
- C. Test Reports: Indicate overall resistance to ground.
- D. Manufacturer's Installation Instructions: Submit for active electrodes.

- E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of components and grounding electrodes.

1.7 QUALITY ASSURANCE

- A. Provide grounding, surge protection and lightning protection of telecommunications system in accordance with latest version of Grounding, Bonding and Electrical Protection chapter of the BICSI TDM Manual, TIA/EIA 607, and NFPA 70.
- B. Perform Work in accordance with State of California Public Work's standards.
- C. Maintain one copy of each document on site.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience.

1.9 PRE-INSTALLATION MEETINGS

- A. Division 01 – General Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.11 COORDINATION

- A. Division 01 – General Requirements: Requirements for coordination.

- B. Complete grounding and bonding of building reinforcing steel prior to concrete placement.

PART 2 - PRODUCTS

2.1 WIRE

- A. Material: Stranded copper.
- B. Grounding Conductor: Copper conductor bare or as indicated on drawings.
- C. Bonding Conductor: Copper conductor bare or as indicated on drawings.

2.2 MECHANICAL CONNECTORS

- A. Manufacturers:
 - 1. Apache Grounding/Erco Inc.
 - 2. Copperweld, Inc.
 - 3. Erco, Inc.
 - 4. ILSCO Corporation.
 - 5. O-Z Gedney Co.
 - 6. Thomas & Betts, Electrical.
 - 7. Substitutions: Section 016000 - Product Requirements.
- B. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

2.3 EXOTHERMIC CONNECTIONS

- A. Manufacturers:
 - 1. Apache Grounding/Erco Inc.
 - 2. Cadweld, Erco, Inc.
 - 3. Copperweld, Inc.
 - 4. ILSCO Corporation.
 - 5. O-Z Gedney Co.
 - 6. Thomas & Betts, Electrical.
 - 7. Substitutions: Section 016000 - Product Requirements.
- B. Product Description: Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove paint at connection points.

3.2 INSTALLATION

- A. Install in accordance with BICSI TDM Manual, TIA/EIA 607, and NFPA 70.
- B. Install grounding and bonding conductors concealed from view.
- C. Install grounding for each rack using 6 AWG THHN, rated for 90 degrees C, insulated, copper stranded conductor to copper communication grounding bus bar located in main telecommunications entrance facility.
- D. Bond main telecommunications grounding system to building grounding electrode system at main electrical service entrance location with 6 AWG THHN, rated for 90 degrees C, insulated, copper stranded conductor.
- E. Install routing for grounding conductor as short and direct as practical.
- F. Install routing of bonding conductors with minimum number of bends and splices. Use sweeping bends.
- G. Install bonding connections with listed bolts, crimp pressure connectors, clamps, or lugs.
- H. Bond backbone cabling at each sheath opening.
- I. Ground data cabinets, racks, cable trays, and mounting hardware located in IDF Room.
- J. Install ground from each piece of equipment to IDF Room grounding bar via an insulated cable no smaller than 6 AWG stranded copper wire. Install proper grounding lug on cable where connecting to racks and grounding bar.
- K. Label grounding conductors and grounding bus bars in accordance with BICSI guidelines.
- L. Permanently attach equipment and grounding conductors prior to energizing equipment.

3.3 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Visually inspect from each bus bar to main grounding electrode service location.
- C. Test in accordance with BICSI TDM Manual, TIA/EIA 607, and NFPA 70.
- D. When improper grounding is found, check entire project and correct. Perform retest.

SECTION 270529 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Conduit supports.
 - 2. Formed steel channel.
 - 3. Spring steel clips.
 - 4. Sleeves.
 - 5. Firestopping relating to electrical work.
 - 6. Firestopping accessories.
 - 7. Equipment bases and supports.
- B. Related Sections:
 - 1. Division 03 - Concrete: Product requirements for concrete for placement by this section.
 - 2. Section 270529 - Hangers and Supports for Communications Systems.
 - 3. Section 280529 - Hangers and Supports for Electronic Safety and Security.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
 - 3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
 - 4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
- B. FM Global:
 - 1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.
- C. California Electrical Code
 - 1. CEC - California Electrical Code.
- D. Underwriters Laboratories Inc.:
 - 1. UL 263 - Fire Tests of Building Construction and Materials.
 - 2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
 - 3. UL 1479 - Fire Tests of Through-Penetration Firestops.
 - 4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
 - 5. UL - Fire Resistance Directory.

1.3 DEFINITIONS

- A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

- A. Firestopping Materials: ASTM E119, UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.
- B. Firestopping Materials ASTM E119, UL 1479 to achieve fire ratings of adjacent construction in accordance with UL Design Numbers noted on Drawings.
- C. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

- A. Firestopping: Conform to CSFM and UL for fire resistance ratings and surface burning characteristics.
- B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

- A. Division 01 – General Requirements: Requirements for submittals.
- B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
- C. Product Data:
 - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
 - 2. Firestopping: Submit data on product characteristics, performance and limitation criteria.
- D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
- E. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.
- F. Manufacturer's Installation Instructions:
 - 1. Hangers and Supports: Submit special procedures and assembly of components.
 - 2. Firestopping: Submit preparation and installation instructions.

- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- H. Engineering Judgements: For conditions not covered by UL listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

- A. Through Penetration Firestopping of Fire Rated Assemblies: ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - 1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
 - 2. Floor Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - a. Floor Penetrations Within Wall Cavities: T-Rating is not required.
- B. Through Penetration Firestopping of Non-Fire Rated Floor Assemblies: Materials to resist free passage of flame and products of combustion.
 - 1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
 - 2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.
- C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.
- D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.
- E. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- F. Perform Work in accordance with State of California Public Work's standard.
- G. Maintain two copies of each document on site.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.9 PRE-INSTALLATION MEETINGS

- A. Division 01 – General Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 – General Requirements: Environmental conditions affecting products on site.
- B. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.
- C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

PART 2 - PRODUCTS

2.1 CONDUIT SUPPORTS

- A. Manufacturers:
 - 1. Cooper B-Line Systems
 - 2. Panduit Corp.
 - 3. Unistrut Corp.
 - 4. Substitutions: Division 01 – General Requirements - Product Requirements.
- B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.
- C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.
- D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

- E. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.
- F. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self locking.

2.2 FORMED STEEL CHANNEL

- A. Manufacturers:
 - 1. Cooper B-Line Systems.
 - 2. Panduit Corp.
 - 3. Unistrut Corp.
 - 4. Substitutions: Division 01 – General Requirements – Product Requirements.
- B. Product Description: Galvanized (12 gage) thick steel. With holes 1-1/2 inches on center.

2.3 SPRING STEEL CLIPS

- A. Manufacturers:
 - 1. Cooper B-Line Systems
 - 2. Substitutions: Division 01 – General Requirements – Product Requirements.
- B. Product Description: Mounting hole and screw closure.

2.4 SLEEVES

- A. Furnish materials in accordance State of California Public Work's standard.
- B. Sleeves for Through Non-fire Rated Floors: 18 gage thick galvanized steel.
- C. Sleeves for Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- D. Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

2.5 FIRESTOPPING

- A. Manufacturers:
 - 1. Dow Corning Corp.
 - 2. Fire Trak Corp.
 - 3. Hilti Corp.
 - 4. International Protective Coating Corp.
 - 5. 3M Fire Protection Products.
 - 6. Specified Technology, Inc.
 - 7. Substitutions: Section 016000 - Product Requirements.

- B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.
 - 1. Silicone Firestopping Elastomeric Firestopping: Silicone elastomeric compound and compatible silicone sealant.
 - 2. Foam Firestopping Compounds: Foam compound.
 - 3. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.
 - 4. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.
 - 5. Firestop Pillows: Formed mineral fiber pillows.
- C. Color: As selected from manufacturer's full range of colors.

2.6 FIRESTOPPING ACCESSORIES

- A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.
- B. Dam Material: Permanent:
 - 1. Mineral fiberboard.
 - 2. Sheet metal.
- C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.
- D. General:
 - 1. Furnish UL listed products or products tested by nationally recognized independent testing laboratory.
 - 2. Select products with rating not less than rating of wall or floor being penetrated.
- E. Non-Rated Surfaces:
 - 1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.
 - 2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Verification of existing conditions before starting work.

- B. Verify openings are ready to receive sleeves.
- C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
- B. Remove incompatible materials affecting bond.
- C. Install backing or damming materials to arrest liquid material leakage.
- D. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- E. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS

- A. Anchors and Fasteners:
 - 1. Concrete Structural Elements: Provide expansion anchors.
 - 2. Steel Structural Elements: Provide beam clamps.
 - 3. Concrete Surfaces: Provide expansion anchors.
 - 4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.
 - 5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
 - 6. Sheet Metal: Provide sheet metal screws.
 - 7. Wood Elements: Provide wood screws.
- B. Inserts:
 - 1. Install inserts for placement in concrete forms.
 - 2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- C. Install conduit and raceway support and spacing in accordance with CEC.
- D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- E. Install multiple conduit runs on common hangers.
- F. Supports:

1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
2. Install surface mounted cabinets and panelboards with minimum of four anchors.
3. In wet and damp locations install steel channel supports to stand cabinets and panelboards 1 inch off wall.
4. Support vertical conduit at every floor.

3.4 INSTALLATION - FIRESTOPPING

- A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.
- B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.
- C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.
- D. Dam material to remain.
- E. Fire Rated Surface:
 1. Seal opening at wall, ceiling, and roof as follows:
 - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
 - b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
 - c. Pack void with backing material.
 - d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.
 2. Where cable tray, conduit, or wireway penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.
- F. Non-Rated Surfaces:
 1. Seal opening through non-fire rated wall, floor, ceiling, and roof opening as follows:
 - a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.
 - b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.
 - c. Install type of firestopping material recommended by manufacturer.
 2. Install escutcheons, floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.

3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.
4. Interior partitions: Seal pipe penetrations at telecommunication rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment as indicated on Drawings. Refer to Section 033000.
- B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct supports of formed steel channel. Brace and fasten with flanges bolted to structure.

3.6 INSTALLATION - SLEEVES

- A. Exterior entries: Seal with adjustable interlocking rubber links.
- B. Set sleeves in position in forms. Provide reinforcing around sleeves.
- C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- D. Extend sleeves through floors 2 inches above finished floor level. Caulk sleeves.
- E. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- F. Install stainless steel escutcheons at finished surfaces.

3.7 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.8 CLEANING

- A. Division 01 – General Requirements: Requirements for cleaning.

- B. Clean adjacent surfaces of firestopping materials.

3.9 PROTECTION OF FINISHED WORK

- A. Division 01 – General Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces from damage by material installation.

END OF SECTION 270529

SECTION 270533 - CONDUITS AND BOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.
- B. Related Sections:
 - 1. Section 260503 - Equipment Wiring Connections.
 - 2. Section 260526 - Grounding and Bonding for Electrical Systems.
 - 3. Section 260529 - Hangers and Supports for Electrical Systems.
 - 4. Section 260553 - Identification for Electrical Systems.
 - 5. Section 262716 - Electrical Cabinets and Enclosures.
 - 6. Section 262726 - Wiring Devices.
 - 7. Section 270533 - Conduits and Backboxes for Communications Systems.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
 - 2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
 - 3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).
- B. National Electrical Manufacturers Association:
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
 - 3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - 6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
 - 7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

- A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.
- B. Underground More than 5 feet outside Foundation Wall: Provide thickwall nonmetallic conduit. Provide cast metal boxes.

- C. Underground Within 5 feet from Foundation Wall: Provide rigid steel conduit. Provide cast metal boxes.
- D. Under Slab on Grade: Provide rigid steel conduit. Provide cast metal boxes.
- E. Outdoor Locations, Above Grade: Provide PVC coated rigid steel conduit. Provide cast metal or nonmetallic outlet, pull, and junction boxes.
- F. Wet and Damp Locations: Provide rigid steel conduit. Provide cast metal outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.
- G. Concealed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
- H. Exposed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

1.4 DESIGN REQUIREMENTS

- A. Minimum Raceway Size: 3/4 inch above grade and once unless otherwise specified.

1.5 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Product Data: Submit for the following:
 - 1. Flexible metal conduit.
 - 2. Liquidtight flexible metal conduit.
 - 3. Nonmetallic conduit.
 - 4. Flexible nonmetallic conduit.
 - 5. Nonmetallic tubing.
 - 6. Raceway fittings.
 - 7. Conduit bodies.
 - 8. Surface raceway.
 - 9. Wireway.
 - 10. Pull and junction boxes.
 - 11. Handholes.
- C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Closeout procedures.

- B. Project Record Documents:
 - 1. Record actual routing of conduits larger than 2 inches.
 - 2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Product storage and handling requirements.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- C. Protect PVC conduit from sunlight.

1.8 COORDINATION

- A. Division 01 – General Requirements: Coordination and project conditions.
- B. Coordinate installation of outlet boxes for equipment connected under Section 260503.
- C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 - PRODUCTS

2.1 METAL CONDUIT

- A. Manufacturers:
 - 1. Allied Tube.
 - 2. Hubbell Wiring Devices .
 - 3. Thomas & Betts Corp.
 - 4. Walker Systems Inc.
 - 5. The Wiremold Co..
 - 6. Substitutions: Section 016000 - Product Requirements.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. Intermediate Metal Conduit (IMC): Rigid steel.
- D. Fittings and Conduit Bodies: NEMA FB 1.

2.2 FLEXIBLE METAL CONDUIT

- A. Manufacturers:
 - 1. Allied Tube.
 - 2. Hubbell Wiring Devices .

3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co..
6. Substitutions: Division 01 – General Requirements - Product Requirements.

B. Product Description: Interlocked steel construction.

C. Fittings: NEMA FB 1.

2.3 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. Allied Tube.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.
6. Substitutions: Division 01 – General Requirements - Product Requirements.

B. Product Description: Interlocked steel construction with PVC jacket.

C. Fittings: NEMA FB 1.

2.4 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied Tube.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.
6. Substitutions: Division 01 – General Requirements - Product Requirements.

B. Product Description: ANSI C80.3; galvanized tubing.

C. Fittings and Conduit Bodies: NEMA FB 1; steel, compression type.

2.5 NONMETALLIC CONDUIT

A. Manufacturers:

1. Allied Tube.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.

6. Substitutions: Division 01 – General Requirements - Product Requirements.

B. Product Description: NEMA TC 2; Schedule 40 PVC.

C. Fittings and Conduit Bodies: NEMA TC 3.

2.6 SURFACE METAL RACEWAY

A. Manufacturers:

1. Hubbell Wiring Devices.
2. Panduit Corp.
3. Walker Systems Inc.
4. The Wiremold Co.

5. Substitutions: Division 01 – General Requirements - Product Requirements.

B. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.

C. Size: As noted on drawings.

D. Finish: As noted on drawings.

E. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories; match finish on raceway.

2.7 SURFACE NONMETAL RACEWAY

A. Manufacturers:

1. Carlon Electrical Products.
2. Hubbell Wiring Devices.
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co.

6. Substitutions: Division 01 – General Requirements - Product Requirements.

B. Product Description: Plastic channel with fitted cover, suitable for use as surface raceway.

C. Size: As noted on drawings.

D. Finish: As noted on drawings.

E. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories, finish to match raceway.

2.8 WIREWAY

- A. Manufacturers:
 - 1. Carlon Electrical Products.
 - 2. Hubbell Wiring Devices.
 - 3. Thomas & Betts Corp.
 - 4. Walker Systems Inc.
 - 5. The Wiremold Co.
 - 6. Substitutions: Section 016000 - Product Requirements.
- B. Product Description: General purpose type wireway.
- C. Knockouts: Manufacturer's standard.
- D. Size: As indicated on Drawings.
- E. Cover: Screw cover.
- F. Connector: Slip-in.
- G. Fittings: Lay-in type with removable top, bottom, and side; captive screws.
- H. Finish: Rust inhibiting primer coating with gray enamel finish.

2.9 OUTLET BOXES

- A. Manufacturers:
 - 1. Carlon Electrical Products.
 - 2. Hubbell Wiring Devices.
 - 3. Thomas & Betts Corp.
 - 4. Walker Systems Inc.
 - 5. The Wiremold Co.
 - 6. Substitutions: Division 01 – General Requirements - Product Requirements.
- B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
 - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.
 - 2. Concrete Ceiling Boxes: Concrete type.
- C. Nonmetallic Outlet Boxes: NEMA OS 2.
- D. Cast Boxes: NEMA FB 1, Type FD, cast fer alloy. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.
- E. Wall Plates for Finished Areas: As specified in Section 262726.
- F. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.10 PULL AND JUNCTION BOXES

- A. Manufacturers:
 - 1. Carlon Electrical Products.
 - 2. Hubbell Wiring Devices.
 - 3. Thomas & Betts Corp.
 - 4. Walker Systems Inc.
 - 5. The Wiremold Co.
 - 6. Substitutions: Division 01 – General Requirements - Product Requirements.
- B. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- C. Hinged Enclosures: As specified in Section 262716.
- D. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
 - 1. Material: Cast aluminum.
 - 2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.
- E. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:
 - 1. Material: Cast aluminum.
 - 2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.
 - 3. Cover Legend: "POWER" or "SIGNAL" or as otherwise noted on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Coordination and project conditions.
- B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 INSTALLATION

- A. Ground and bond raceway and boxes in accordance with Section 260526.
- B. Fasten raceway and box supports to structure and finishes in accordance with Section 260529.
- C. Identify raceway and boxes in accordance with Section 260553.

- D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.3 INSTALLATION - RACEWAY

- A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.
- B. Arrange raceway supports to prevent misalignment during wiring installation.
- C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 260529; provide space on each for 25 percent additional raceways.
- E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports
- F. Do not attach raceway to ceiling support wires or other piping systems.
- G. Construct wireway supports from steel channel specified in Section 260529.
- H. Route exposed raceway parallel and perpendicular to walls.
- I. Route raceway installed above accessible ceilings parallel and perpendicular to walls.
- J. Route conduit under slab from point-to-point.
- K. Maintain clearance between raceway and piping for maintenance purposes.
- L. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.
- M. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- N. Bring conduit to shoulder of fittings; fasten securely.
- O. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.
- P. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

- Q. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows for bends in metal conduit larger than 2 inch size.
- R. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.
- S. Install fittings to accommodate expansion and deflection where raceway crosses seismic and expansion joints.
- T. Install suitable pull string or cord in each empty raceway except sleeves and nipples.
- U. Install suitable caps to protect installed conduit against entrance of dirt and moisture.
- V. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.
- W. Close ends and unused openings in wireway.

3.4 INSTALLATION - BOXES

- A. Install wall mounted boxes at elevations to accommodate mounting heights [as indicated on Drawings.
- B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.
- C. Orient boxes to accommodate wiring devices oriented as specified in Section 262726.
- D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.
- H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

- I. Install stamped steel bridges to fasten flush mounting outlet box between studs.
- J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- K. Install adjustable steel channel fasteners for hung ceiling outlet box.
- L. Do not fasten boxes to ceiling support wires or other piping systems.
- M. Support boxes independently of conduit.
- N. Install gang box where more than one device is mounted together. Do not use sectional box.
- O. Install gang box with plaster ring for single device outlets.
- P. Device boxes under conference room tables shall be pedestal type by Hubbell or equal.

3.5 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with Section 078400.
- B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.
- C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.
- D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.6 ADJUSTING

- A. Division 01 – General Requirements: Testing, adjusting, and balancing.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. Install knockout closures in unused openings in boxes.

3.7 CLEANING

- A. Division 01 – General Requirements: Final cleaning.
- B. Clean interior of boxes to remove dust, debris, and other material.
- C. Clean exposed surfaces and restore finish.

END OF SECTION 270533

SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Nameplates.
 - 2. Labels.
 - 3. Wire markers.
 - 4. Conduit markers.
 - 5. Stencils.
 - 6. Underground Warning Tape.
 - 7. Lockout Devices.
- B. Related Sections:
 - 1. Division 09 - Finishes: Execution requirements for painting specified by this section.
 - 2. Section 260553 - Identification for Electrical Systems.

1.2 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Product Data:
 - 1. Submit manufacturer's catalog literature for each product required.
 - 2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

1.3 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 – General Requirements: Requirements for transporting, handling, storing, and protecting products.

- B. Accept identification products on site in original containers. Inspect for damage.
- C. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- D. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 – General Requirements: Environmental conditions affecting products on site.
- B. Install nameplates only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

1.7 EXTRA MATERIALS

- A. Division 01 – General Requirements: Requirements for extra materials.

PART 2 - PRODUCTS

2.1 NAMEPLATES

- A. Furnish materials in accordance with State of California Public Work's standards.
- B. Product Description: Laminated three-layer plastic with engraved black letters on white contrasting background color.
- C. Letter Size:
 - 1. 1/8 inch high letters for identifying individual equipment and loads.
- D. Minimum nameplate thickness: 1/8 inch.

2.2 LABELS

- A. Furnish materials in accordance with State of California or District's standards.
- B. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background.

2.3 WIRE MARKERS

- A. Furnish materials in accordance with State of California or District's standards.
- B. Description: Tubing type wire markers.
- C. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.
2. Control Circuits: Control wire number as indicated on shop drawings.

2.4 CONDUIT AND RACEWAY MARKERS

- A. Furnish materials in accordance with State of California or District's standards.
- B. Description: Nameplate fastened with adhesive.

2.5 STENCILS

- A. Furnish materials in accordance with State of California or District's standards.
- B. Stencils: With clean cut symbols and letters of following size:
 1. Up to 2 inches Outside Diameter of Raceway: 1/2 inch high letters.
 2. 2-1/2 to 6 inches Outside Diameter of Raceway: 1 inch high letters.
- C. Stencil Paint: As specified in Division 09, semi-gloss enamel, colors conforming to the following:
 1. Black lettering on white background.

2.6 UNDERGROUND WARNING TAPE

- A. Description: 4 inch wide plastic tape, detectable type, colored yellow with suitable warning legend describing buried electrical lines.

2.7 LOCKOUT DEVICES

- A. Lockout Hasps:
 1. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Division 09 for stencil painting.

3.2 INSTALLATION

- A. Install identifying devices after completion of painting.
- B. Nameplate Installation:
 1. Install nameplate parallel to equipment lines.
 2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.

3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.
 4. Secure nameplate to equipment front using rivets.
 5. Secure nameplate to inside surface of door on recessed panels in finished locations.
- C. Label Installation:
1. Install label parallel to equipment lines.
 2. Install label for identification of individual control device stations.
 3. Install labels for permanent adhesion and seal with clear lacquer.
- D. Wire Marker Installation:
1. Install wire marker for each conductor at pull boxes, outlet and junction boxes.
 2. Mark data cabling at each end. Install additional marking at accessible locations along the cable run.
 3. Install labels at data outlets identifying patch panel and port designation as indicated on Drawings.
- E. Stencil Installation:
1. Apply stencil painting in accordance with Division 09.
- F. Underground Warning Tape Installation:
1. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.

END OF SECTION 270553

SECTION 271343 - COMMUNICATIONS SERVICES CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Provisions of the General and Supplementary Conditions and Division 01 apply to this section.
- B. Scope of work
- C. This Section includes the following:
 - 1. Wire
 - 2. Cable
 - 3. Connecting devices
 - 4. Pathways
 - 5. Outlet Boxes
 - 6. Installation
 - 7. Labeling standards
 - 8. Documentation deliverables
 - 9. Manufacturer certification requirements
- D. Related Sections:
 - 1. Section 260500 – Common Work Results Electrical

1.2 REFERENCES

- A. Standards, Guidelines and Practices:
 - 1. Installation and certification of all unshielded twisted pair (UTP) cabling in accordance with the latest available TIA/EIA requirements for Category 6 cabling installations is required.
 - 2. Structured Communications Cabling Systems (SCCS) and SCCS Pathways shall be installed in a "neat and workmanlike manner" as specified by ANSI/NECA/BICSI 568-2001 and National Electrical Code (NEC) Sections 110-12 and 800-6.
- B. The SCCS contractor shall adhere to and comply with the latest versions and/or revisions of each applicable standard. Among the various standards, guidelines and practices applicable to this project are the following (latest edition):
 - 1. Building Industry Consulting Services International (BICSI)
BICSI Telecommunications Distribution Methods Manual (TDMM latest edition)
 - 2. California Building Standards Commission
California Electrical Code Title 24, Part 3
 - 3. Federal Communications Commission (FCC)

- FCC Part 68.5 Establishment of Telephone Premises Wiring Attestation List
4. Insulated Cable Engineers Association (ICEA)
- ANSI/ICEA S-80-576 Communication Wire and Cable for Wiring of Premises
5. National Electrical Manufacturers Association (NEMA)
- NEMA WC 63 Telecommunications Cables
6. National Fire Protection Association (NFPA)
- NFPA 70 National Electrical Code
7. Public Works Standards, Inc.
- GREENBOOK Green Book Standard Specifications for Public Works Construction
8. Rural Electrification Administration (REA)
- REA TECM 823 Electrical Protection by Use of Gas Tube Arrestors
9. Telecommunications Industry Association (TIA)
- TIA/EIA-455-21 FOTP-21 Mating Durability of Fiber Optic Interconnecting Devices
- TIA-492AAAA 50 μ M Core Diameter/125 μ M Cladding Diameter Class 1a Multimode, Graded Index Optical Waveguide Fibers
- TIA-526-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant – OFSTP-14
- TIA-568-B.1, B.2 Commercial Building Telecommunications Wiring Standard
- TIA-568-B.3 Optical Fiber Cabling Components Standard (ANSI/TIA-568-B.3)
- TIA-569-A Commercial Building Standard for Telecommunications Pathways and Spaces (ANSI/TIA-569-A)
- TIA-569-A-1 Commercial Building Standard for Telecommunications Pathways and Spaces, Addendum 1 (ANSI/TIA-569-A-1) This addendum defines the surface raceways contained in the work area outlets.
- TIA-569-A-2 Commercial Building Standard for Telecommunications Pathways and Spaces, Addendum 2 (ANSI/TIA-569-A-2) This addendum defines the furniture pathways and spaces contained in work areas.
- TIA-606-A (Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

TIA-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications (ANSI/J-STD--607-A)

TIA TSB-75 Additional Horizontal Cabling Practices for Open Offices

TIA TSB-758 Customer-Owned Outside Plant Telecommunications Cabling Standard

10. Underwriters Laboratories Inc. (UL)

UL 444 Communications Cables

UL 467 Grounding and Bonding Equipment

UL 497 Safety Protector for Paired Conductor Communication Circuit

UL 514C Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

UL 910 Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables Used in Spaces Transporting Environmental Air

UL 969 Marking and Labeling Systems

UL 1286 Office Furnishings

UL 1581 Electrical Wires, Cables and Flexible Cords

UL 1666 Flame Propagation Height of Electrical and Optical-Fiber Cables Installed in Vertical Shafts

UL 1863 Communication Circuit Accessories

C. Federal, state, local and County codes, rules, regulations and ordinances governing the work, as well as various additional standards, guidelines and practices may apply and shall be incorporated as part of these Technical Specifications.

D. In reviewing the various Contract Documents, the SCCS Contractor shall be responsible for noting conflicts between proposed design/concepts and the applicable standards, guidelines and practices. A written Request for Information (RFI) shall be developed by the SCCS Contractor and submitted to the County and/or the County's Representative prior to commencing any work impacted by such conflicts. Such RFIs shall describe the conflict/violation and, if appropriate, recommend alternative solutions with associated costs. The County and/or the County's Representative warrants that they will diligently strive to address such RFIs in order to minimize negative impact on each SCCS installation completion schedule.

E. Where the requirements of the Contract Documents are more stringent than applicable codes, rules, regulations, ordinances, standards, guidelines and

practices, the Contract Documents shall apply. In all other instances, the most current standards, guidelines and practices shall apply.

1.3 DEFINITIONS

- A. OFOI = Owner Furnished, Owner Installed.
- B. CFCI = Contractor Furnished, Contractor Installed
- C. SCCS: Structured Communications Cabling System.
- D. SCCS Contractor: SCCS Contractor to whom the contract is awarded and who will be the prime contractor responsible for completion of the work described herein.
- E. County Representative: Other parties as appointed by The County as an authorized representative of the County.
- F. LAN: Local area network.
- G. UTP: Unshielded twisted pair.
- H. RMU: Rack Mount Unit (1.75 inches)

1.4 SUBMITTALS

- A. Product Data: Include data on features, ratings, and performance for each component specified.
- B. In addition to information required by the County "Bid Form" certain additional information is required for submission. These items include the following:
 - 1. SCCS Contractor shall be PanGen Solutions certified by the manufacturer for a minimum of twelve (12) months prior to bid submittal date.
 - 2. SCCS Contractor shall have valid PanGen Solutions certification for the entire project duration of the installation agreement. In addition the SCCS Contractor shall have no known pending action or intent by Panduit and/or SCCS Contractor to terminate or limit the SCCS contractor status as a Panduit Certified installer.
 - 3. SCCS Contractor shall attach to bid response a copy of their current PanGen Solutions certificate demonstrating valid certification in the Southern California region. The attached certificate is to specifically cite the name of proposing SCCS contractor.
 - 4. SCCS Contractor shall be certified to provide and furnish a completely installed system that meets all PanGen Solutions warranty program requirements for an extended warranty of fifteen (15) years minimum duration.
 - 5. SCCS Contractor shall provide and furnish all materials and labor for a completely installed structured communications cabling system (SCCS)

that receives manufacturer's warranty certification issued exclusively by the manufacturer only.

6. A statement listing SCCS contractor's years of experience in providing and installing PanGen Solutions certified Structured Communications Cabling Systems.
7. A summary of at least five (5) similar PanGen Solutions certified projects completed and installed by SCCS Contractor preferably within a fifty-mile radius of County facilities.
8. A list of references, including contact names and telephone numbers, for a minimum of five (5) such projects, preferably within a fifty-mile radius of County facilities.
9. The resume of project manager(s) and lead technician(s) to be assigned to this project.

- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For voice and data communication cabling to include in emergency, operation, and maintenance manuals.
- E. All components shall be eligible for PanGen warranty.

1.5 QUALITY ASSURANCE (AS APPLICABLE TO THE SCOPE)

- A. Installer Qualifications: System installer must have on staff a Registered Communication Distribution Designer (RCDD) certified by Building Industry Consulting Service International.
- 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 NFPA 70.

1.6 COORDINATION

- A. Coordinate layout and installation of voice, data, and video communication pathways with other County contractors and equipment suppliers.
 1. Meet jointly with other contractors, equipment suppliers, and County to exchange information and agree on details of equipment arrangements and installation interfaces.
 2. Record agreements reached in meetings and distribute to other participants.

1.7 SYSTEM CERTIFICATION AND/OR WARRANTY

- A. The installation must be certified to meet the latest available PanGen Solutions warranty program requirements for an extended warranty of fifteen (15) years minimum duration. At minimum, such warranty shall, at no additional cost to the County, provide a system warranty covering the installed SCCS against defects

in workmanship, components and performance. At a minimum, general features of the warranty shall include:

1. An installation warranty extending to the SCCS protecting the County against defects in workmanship for a minimum period of two years from the date of system acceptance. Such warranty shall provide all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within original specifications after the repairs are accomplished.
 2. A system performance warranty extended by the SCCS component manufacturer for a period of not less than fifteen (15) years from date of system acceptance. The performance warranty shall warrant the installed horizontal copper and, as applicable, the installed horizontal and backbone fiber optic portions of the system. All such links and segments shall be warranted in accordance with the latest applicable requirements as defined by TIA.
- B. As outlined herein, the County intends that the resulting SCCS will be warranted under the extended warranty provisions extended by the manufacturer. The Technical Specification is based on the products being manufactured by Panduit and others. The warranty shall extend to UTP and fiber optic portions of the installation to the fullest extent allowed by the manufacturer.

1.8 SCCS COMPONENTS (AS APPLICABLE TO THE SCOPE)

- A. The Contract Documents generally outline industry standard components to be installed as part of the County's SCCS installation requirements. Such identification is intended to be general in nature rather than exhaustive. All stated quantities are subject to validation by SCCS Contractor. SCCS Contractor is reminded that differences between estimated quantities and those reasonably derived based from the Contract Documents (as well as through bid conferences, job walks, addendums, and other distribution of information) shall be the responsibility of the SCCS Contractor. There shall be no additional cost incurred by the County for complying with the specifications and requirements of the Contract Documents.
- B. Any variance from those components identified on the drawings and/or below shall be submitted to the County/County's Representatives for approval prior to ordering and installation; the risk for all costs incurred by the SCCS Contractor for materials ordered prior to such written approval shall be borne entirely by the SCCS Contractor. Nonetheless, it is imperative that the SCCS Contractor determine the availability of necessary materials and propose equivalent substitutes as necessary to meet all installation milestones. Delays in SCCS installations due to lack of product availability are unacceptable. As catalog numbers change frequently, the SCCS Contractor must verify all part numbers prior to ordering materials. Clarifications will be issued in response to written Requests for Information (RFIs).
- C. All UTP, fiber optic cabling, inner-duct and cable ties, where required, will be plenum-rated (i.e., CMP, ONFP). Copper and fiber optic backbone cable

intended for installation within conduit, riser shafts and chases, etc., shall be at a minimum, rated CMR (riser rated). Unrated cable (such as filled ASP) shall not be installed within the structure except when placed within EMT, PVC or RGS conduit.

- D. Throughout this specification, Panduit and other manufacturers are cited. These citations are for the purpose of establishing quality and performance criteria.

1.9 DELIVERY AND STORAGE

- A. SCCS Contractor shall provide a materials schedule prior to the start date of cable installation. Material schedule shall specify all material quantities and their delivery date for this project.
- B. SCCS Contractor shall provide protection from weather, moisture, dirt, dust and other contaminants for telecommunications cabling and pathway equipment placed in storage.

PART 2 - PRODUCTS (CFCI UNLESS NOTED OTHERWISE)

2.1 SYSTEM REQUIREMENTS

- A. Components shall be UL or third party certified. SCCS Contractor shall provide, install, and furnish a complete system of telecommunications pathway components and support structures, pathways, and spaces complete with conduits, pull wires, raceways, junction boxes, underground pull boxes and cable support per the County SCCS requirements. Fixed cables and pathway systems for telecommunications systems shall be UL listed or third party independent testing laboratory certified, and shall comply with NFPA 70. SCCS shall be installed and certified so as to provide a 20-year product warranty and 15-year performance warranty.
- B. Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance.

2.2 PATHWAYS (HORIZONTAL)

- A. Pathways shall consist of conduits; pull boxes, sleeves, cable runway, raceways, non-continuous cable support, ceiling hangers, J-hooks and outlet boxes as per the drawings. Provide grounding and bonding as required by TIA-569 and TIA-607.
- B. See Article 4 of these specifications.

2.3 DISTRIBUTION FRAMES (OFOI)

- A. Provide intermediate distribution facilities (IDFs), as required by the County and construction documents for terminating and cross-connecting permanent cabling links.

2.4 EQUIPMENT ENCLOSURE

- A. Equipment cabinets shall consist of frame, sides, top, front door and back door, and will be Owner Furnished, Owner Installed.
- B. Material:
 - 1. All enclosures shall have grounding installed by the SCCS contractor.

2.5 WIRE MANAGEMENT (OFOI)

- A. All equipment racks, wall mount racks, and wall mount cabinets shall be equipped with horizontal wire management (see section 2.20 for horizontal wire managers).

2.6 EQUIPMENT CABINETS WALL MOUNTED

- A. Cabinet shall be mounted on Contractor furnished and installed plywood backboard in location to be determined, and will be Owner Furnished, Owner Installed.
- B. An Owner Furnished, Owner Installed cooling fan assembly supplied with power cord shall be available.
- C. One (1) Owner Furnished, Owner Installed single gang 120V electrical outlet shall be located between 3U and 4U. Power shall be contractor wired and must be on a dedicated 20A circuit.

2.7 BACKBOARDS

- A. The SCCS Contractor shall provide 3/4 inches A/C void-free, fire-rated plywood as required by the County.
- B. Backboards shall be mounted vertically, starting 6 inches above finished floor, and secured to the walls.
- C. All plywood panels must be mounted in contact with one another, leaving no gaps between sheets.
- D. Material:
 - 1. All backboards are to be constructed of 4 feet by 8 feet plywood, or as indicated on plans.
 - 2. At the County designated wall mount IDF rack and cabinet locations, the SCCS Contractor shall install 3/4 inches A/C void-free, fire-rated plywood

with adequate height and width to support the mounting of wall mount racks or cabinets.

3. All exposed edges must be chamfered. Screws, bolts, washers and/or nuts are to be counter sunk to be flush with the surface of the plywood.

- E. IDF backboards shall be equipped with sufficient quantities of 2" and 4" 'D' rings spaced every 12" apart.

2.8 GROUNDING AND BONDING PRODUCTS (AS APPLICABLE TO GROUNDING AND BONDING CONDUCTORS ONLY)

- A. Comply with UL 467, TIA-607 and NFPA 70. Components shall be identified as required by TIA-606.
- B. IDF Racks:
 1. All IDF racks shall be installed with a telecommunications grounding bus bar (TGB) the TGB shall be installed in accordance with TIA-607. The TGB shall be grounded to the nearest building ground with a #6 AWG insulated conductor.
 2. IDF ground rods shall consist of:
 - a. Fargo clamp: Shall be cast from copper, silver-plated, and furnished with copper bolt. Ground rod: Shall be manufactured of high strength high carbon steel, with electrolytically bonded jacket of copper on surface, and meet UL Spec. 467 and ANSI C-33.8-1072.

2.9 FIRESTOPPING MATERIAL

- A. Contractor shall provide all necessary fire stopping of openings through which cable is installed under this specification, in accordance with NFPA 70 and all local codes. This includes installation in conduits, raceways, or bare penetrations. Provide and install UL 1479 approved (Fire Barrier Caulk) firestop material.

2.10 SURFACE MOUNTED RACEWAY

- A. Conceal cable pathways within walls and ceilings whenever possible.
- B. Surface mounted raceway is to be utilized in dry interior locations only as covered in Article 352 part B of the National Electrical Code, as adopted by the National Fire Protection Association and as approved by the American National Standards Institute.
- C. As required, non-metallic tamper resistant surface mounted raceway shall be used to route, protect and conceal data, voice, video fiber optic and/or power cabling.

- D. Surface mounted raceway shall be listed as suitable for use in applications having up to 600 volts between conductors by Underwriters Laboratories, Inc., when screw secured and installed per instructions.
- E. Material:
 - 1. Non-metallic surface mounted raceway shall be Panduit type LD101W-A single channel for data, and Panduit type TG-70 multi-channel for power and data.
 - 2. Non-metallic surface mounted raceway shall be off white in color.
 - 3. The raceway will include a full complement of fittings consisting of, but not limited to, elbows (internal and external), couplings for joining raceway sections, blank end fittings for closing open ends of the raceway, entrance fittings, reducer fittings, and tee fittings. The multi-channel raceway shall maintain complete separation of the power and data channels.
 - a. Fittings shall incorporate a minimum 1" bend radius as recommended for Category 6 UTP and Fiber Optic cables. Non-metallic surface raceway will be manufactured in 6ft lengths from impact-resistant material with a flammability rating of U.L. 94V-0. Raceway finish shall be pure color and will resist scratches and dents and will not peel or corrode. Raceway shall be compatible with the PANDUIT® PAN-NET™ Network Cabling System.
 - b. A plastic device mounting bracket and trim plate shall be available to install devices horizontally in multi-channel raceway. Trim plate shall overlap cover, eliminating seam. Faceplates shall be available to accept a variety of power and data/communication devices. Plastic must be compatible with UL 94 for Plastic Materials.
 - 4. Notching or modifications of raceway and fittings shall not be permitted.

2.11 COPPER PATCH PANELS (OFOI)

- A. One patch panel port shall be provided for each workstation served from MDF or IDF. SCCS Contractor shall supply and install as many patch panels in the MDF and/or IDF as necessary to service all workstations.
- B. Quantities of Mini-Com modules are based on the number of UTP cables originating at wall outlets and terminating at the patch panel.
- C. Material:
 - 1. Patch panels shall consist of a metal patch panel with four (4) port snap in faceplates, which are removable from the front.
 - 2. Patch panels shall mount to standard 19" racks.
 - 3. Patch panels shall be modular, accepting all Mini-Com modules.
 - 4. Patch panels shall be available with labels that follow TIA 606 labeling standards.
- D. Manufacturer: Patch panels for less than 24 cable runs shall be Panduit DP24688TGY; patch panels for 24 cable runs or more shall be Panduit

DP48688TGY; all patch panels shall include Panduit SRBBRM-KIT strain relief brackets.

- E. Panel placement shall be per diagram.

2.12 HORIZONTAL WIRE MANAGEMENT (OFOI)

- A. All equipment racks, wall mount racks and wall mount cabinets shall be equipped with horizontal wire management.
- B. Wire management placement shall be per diagram.
- C. Materials:
 - 1. All horizontal wire managers shall be heavy duty painted black metal and rigid PVC units designed specifically to connect to equipment frames. All wire managers shall be secured to the frames and shall provide a clear and unobstructed pathway in which to route the cables.
 - 2. The in-frame horizontal managers shall be 2 RMU in height and extend from side rail to side rail.
 - 3. Horizontal wire managers shall be equipped with a 3" X 3" slotted duct and cover on front and a 2" X 5" slotted duct and cover on back.
 - 4. Horizontal wire managers shall be equipped with bend radius control clips and strain relief clips.
 - 5. 1U space per copper patch panel shall be left and cable management set for Owner Furnished, Owner Installed network switch.
- D. Manufacturer: Horizontal wire managers shall be Panduit WMPF1E for 48-port patch panels, and Panduit WMPFSE for each 24-port patch panel.

2.13 COMMUNICATIONS CABLING (OFOI)

- A. Cabling shall be UL listed for the application and shall comply with TIA-568-B.1, B.2 and NFPA 70. Cabling shall consist of Category 6 UTP. Plenum cables shall comply with UL 910. Provide a labeling system for cabling as required by TIA-606 and UL 969.
- B. Cabling manufactured more than 12 months prior to date of installation shall not be used.
- C. All cable terminations shall be by Panduit or (OFOI) the County approved equal.

2.14 WORK STATION OUTLET ASSEMBLIES (OFOI)

- A. Jacks shall comply with FCC Part 68.5, and TIA-568-B.1 and B.2.
- B. Jacks shall accommodate UTP or OFN and work in concert with Panduit TG-70 nonmetallic raceway.
- C. Material:

1. UTP jacks for data shall be RJ-45 designation T568B type, UL 1863 listed, eight position, constructed of high impact rated thermoplastic housing rated for Category 6 service.
2. UTP jacks for data shall be Category 6 hardware and shall comply with the attenuation requirements contained in TIA-568-B.1 and B.2.
3. UTP jacks for data shall be black in color.
4. UTP jacks for data shall be Panduit CJ688TGBK.
5. UTP jacks for wireless access points shall be yellow in color.
6. UTP jacks for wireless access points shall be Panduit CJ688TGYL.
7. Panduit Mini-Com CMBIW-X blank modules shall be installed in all unused faceplate openings.
8. Where required, wall phone plates shall be AT&T or Suttle 630B stainless steel.
9. Telecommunications faceplates shall comply with UL 514C, and TIA-568-B.1 and B.2; flush and surface mount design constructed of high impact thermoplastic material.
10. Telecommunications faceplates shall accept inserts which snap in and out of faceplate frames.
11. All telecommunications faceplate inserts shall be front releasable.
12. Telecommunications faceplates shall be available in single gang and double gang frames.
13. Telecommunications faceplates shall be supplied with labels and label cover/screw covers.
14. Telecommunications faceplates shall be off-white in color.
15. Telecommunications faceplates shall allow installation of Panduit Mini-Com sloped inserts and Panduit Mini-Com D-Subminiature inserts.
16. Stenciled lettering for data circuit identification shall be provided by machine printed labeling using thermal ink transfer process.

D. Manufacturer:

1. Wall mounted workstation outlet assemblies shall include Panduit CBEIW and CBEIW-2G Mini-Com faceplate frames. CBEIW faceplate frames shall be supplied with CHS2IW-X inserts and CMBIW-X Mini-Com blanks for all unused ports. CBEIW-2G faceplate frames shall be supplied with CHF2MIW-X Mini-Com module inserts and CHB2MIW-X blank inserts.
2. Panduit TG-70 surface raceway mounted work station outlet assemblies shall include Panduit two port and four port single gang, communications snap-on faceplates. All unused ports shall be supplied with CMBIW-X Mini-Com blanks.

2.15 HORIZONTAL CABLING (OFOI)

- A. Horizontal cabling shall comply with NFPA 70, NEMA WC 63, ANSI/ICEA S-80-576 and performance characteristics in TIA-568-B.1 and B.2 standards for UTP, four-pair 100 ohm cabling.
- B. Material:

1. Horizontal cabling shall provide four each individually twisted pair, 24 AWG or 22 AWG conductors enclosed by an overall jacket.
2. Individual pairs shall be constructed to contain minimum two twists per foot per each pair.
3. Overall diameter of four pair cable shall not exceed 0.25 inches.
4. Ultimate breaking strength shall be minimum 90 pounds.
5. Four pair cable shall withstand a bend radius of one-inch minimum at a temperature of minus 20 degrees C maximum without jacket or insulation cracking.
6. Conductors shall be color coded and polarized in accordance with TIA-568-B.1 and B.2.
7. Category 6 UTP cable for telephone systems and local area networks shall exceed TIA-568-B.1 and B.2 standards and requirements.
8. Conductor shall be 22 or 24 AWG solid annealed copper.
9. Cable shall be plenum rated where required and shall comply with NFPA 70, UL 444, and UL 910.
10. Category 6 data cable jacket color shall be black.

C. Manufacturer: Horizontal cabling shall be manufactured by General Cable.

2.16 WIRELESS ACCESS POINT CABLING (OFOI)

- A. Terminate on 2-port surface-mount box, Panduit CBX2AW-AY.
- B. Install yellow jacks, Panduit CJ688TGYL.

PART 3 - EXECUTION (AS APPLICABLE TO THE SCOPE)

3.1 GENERAL

- A. All installation work shall be performed according to published industry guidelines, rules and regulations. All Panduit® system equipment shall be installed according to PanGen Solutions procedures.
- B. No cables shall be spliced without written authorization from the County.
- C. The bend radius of any cable installed must not exceed the manufacturer's specifications. In those cases, such as in surface raceway, where the minimum radius cannot be maintained, a 90 degree fitting is to be used provided the performance criteria is not jeopardized.

3.2 INSTALLATION

- A. The Structured Communications Cabling System and pathway, including the horizontal and pathway systems, telecommunications outlet/connector assemblies, and associated hardware shall be installed in accordance with TIA-568-B.1 and B.2, TIA-569, NFPA 70, and UL standards as applicable.

- B. SCCS Contractor shall provide all necessary tools and materials not specified, (tie wraps, "D" rings, screws, consumables, hardware, etc.) and equipment, (ladders, hydraulic lifts, storage containers, etc.) necessary to provide a complete and operating system within the scope of work.
- C. Installation methodologies shall adhere to manufacturer installation procedures so as to not violate certifications (i.e. UL).
- D. All work shall be performed in a good workmanship-like manner leaving each location in the same or better condition as at the start of each project.
- E. The County designated representative shall be provided weekly progress reports and weekly crew schedules by the SCCS Contractor.
- F. Periodic on-site inspections will be done during the course of installation.
- G. The County reserves the right of "local jurisdiction" for final approval.
- H. When indicated on drawings, contractor shall reuse existing copper and fiber optic backbone cables.

3.3 OPEN CABLE (AS APPLICABLE TO THE SCOPE)

- A. Use only where specifically designated by the County and construction documents and only when approved by the County.
- B. When not run in surface mounted raceway or conduit, the SCCS Contractor shall utilize non-continuous cable support above suspended ceilings and in all ceiling spaces.
- C. Ceiling wires shall not be used to support SCCS cabling. The SCCS contractor shall provide and install SCCS dedicated support wire for SCCS cable support.
- D. Comply with TIA-568-B.1, B.2 and TIA-569.
- E. Install cabling above suspended ceilings 6 to 12 inches above ceiling T-bar using cable hooks spaced on 48 inch centers and securely attached to structural ceiling. Cable hooks shall be installed on SCCS dedicated support wires.
- F. Do not exceed cable pull tensions recommended by the manufacturer.
- G. Plenum cable shall be used where required by industry standards, building and safety codes and the County rules and regulations. Plenum cables shall comply with flammability plenum requirements of NFPA 70 and shall comply with UL 910.
- H. Avoid routing copper cable in areas where there may be high levels of electromagnetic interference (EMI). EMI is caused by AC power lines, broadcast

signals, X-ray equipment, motors, generators, and fluorescent lights. UTP cables shall be routed at least 5 inches away from fluorescent lighting fixtures.

- I. Cables shall be placed in the support device, J-hooks located every 4 feet, as long as they are separately bundled and tie-wrapped using Velcro ties only.
- J. Plastic Tie-Wraps shall not be used.
- K. Cabling shall be organized and identified so as to facilitate locating and handling individual sheaths for maintenance functions.
- L. Each bundle shall be neatly tied without over cinching or stressing cable.
- M. Bundles shall be clearly marked identifying the IDF and room to which routed, the station numbers served by the bundle, and any other information that may assist in administration.
- N. Great care shall be taken by the SCCS Contractor to protect all cabling from physical damage.

3.4 HORIZONTAL CABLING (AS APPLICABLE TO THE SCOPE)

- A. Install horizontal cabling and pathway as designated by the County and construction documents, between MDF and/or IDF and telecommunications outlet assemblies at workstations, in accordance with TIA-568-B.1 and B.2 and TIA-569.
- B. MDF and IDF terminations of data cables shall be in rack mounted patch panels.
- C. The SCCS Contractor will coordinate with the County for placement information of each outlet to be completed under this specification. Basic outlet configurations will be designated by the County and indicated on construction drawings. Coordinate with the County for outlet configuration details and approval.
- D. SCCS Contractor shall provide and install to work station outlet locations with suitable infrastructure for routing cables from the outlet location to and into the appropriate rack or panel in the MDF or IDF.
- E. The SCCS Contractor is responsible for replacement and reinstallation of any installed cable that does not meet the latest ANSI and TIA performance parameters, without cost to the County.
- F. In general, horizontal station cables will: Originate at the outlet location; extend through the ceiling space via wire hanger, cable tray, conduits/sleeves and/or other cable pathways, enter the MDF or IDF as applicable, and transition to the appropriate rack, cabinet or panel for termination.

3.5 WORK STATION OUTLETS (AS APPLICABLE TO THE SCOPE)

- A. Terminate UTP cable in accordance with TIA-568-B.1, B.2 and wiring configuration T568B.
- B. The SCCS Contractor will coordinate with the County for placement information of each outlet to be completed under this specification. Basic outlet configurations will be designated on construction drawings and approved by the County. Coordinate with the County for outlet configuration details.
- C. SCCS Contractor shall provide and install to work station outlet locations with suitable infrastructure for routing cables from the outlet location to and into the appropriate rack or panel in the MDF or IDF.
- D. Blank inserts are to match the faceplate color.
- E. Work station outlet configurations are also designated on construction drawing symbol legend and faceplate details. Any deviation from these outlets shall be coordinated and approved by the County.

3.6 TELECOMMUNICATIONS CABLING TESTING (OFOI)

- A. Perform telecommunications cabling inspection, verification, and performance tests in accordance with TIA-568-B.1, B.2 and B.3.
- B. All testing personnel shall be trained on testing equipment tools to assure that complete and accurate testing results are obtained / provided.

3.7 INSPECTION (OFOI)

- A. Visually inspect jacket materials for UL or third party certification markings.
- B. Inspect cabling terminations in telecommunications rooms and at workstations to confirm color code for tip and ring pin assignments, and inspect cabling connections to confirm compliance with TIA-568-B.1, B.2 and TIA-570.
- C. Visually confirm Category 6 marking of UTP cables, jacks, patch panels and UTP patch cables.

3.8 VERIFICATION TESTS (OFOI)

- A. Perform 100 MHz near end cross talk (NEXT) and attenuation tests for Category 6 systems installations.
- B. Perform OFN end-to-end attenuation tests using an optical time domain reflectometer (OTDR) and manufacturer's recommended test procedures. Perform tests in accordance with TIA-526-14-A, Method B for horizontal, multimode OFN. Perform verification acceptance tests and factory reel tests.

3.9 PERFORMANCE TESTS (OFOI)

- A. Category 6 permanent links; Perform UTP permanent link tests in accordance with TIA-568-B.1, B.2 and manufactures guidelines.
- B. Tests shall include wire map, length, attenuation, NEXT, FEXT, and propagation delay.

3.10 FINAL VERIFICATION TESTS (OFOI)

- A. Perform verification tests for UTP systems after the complete communications cabling and workstation jacks are installed.
- B. Final test results shall include summary pages for each IDF/MDF as required.
- C. Test results shall be provided to the County representative in both hard and soft copy within 10 business days after each SCCS installation is completed.

3.11 VOICE AND DATA SYSTEMS LABELING PROCEDURES

- A. The labeling shall be in accordance with the TIA-606 standards.
- B. The labeling shall be computer software generated and printed with readable fonts and black ink.
- C. The ink and label shall be water and smear-proof for both indoor and outdoor use.
- D. Samples of each type of media showing label type, labeling format, font size and ink shall be submitted for the County approval.
- E. Voice and Data Systems Labeling
 1. The voice and data systems labeling shall include all related equipment, cables, racks and RJ-45 outlets.
 2. All cables shall be labeled with a unique ID affixed above the group of ports corresponding to the station jack / location.
 3. All patch panels shall be labeled with a unique ID affixed above or below the station jack / location with its corresponding data feed cabinet and terminating patch panel.
 4. Label all cables at each end of the cable designating the rack and room number.
 5. ID to be constructed as follows: RMxxx where "xxx" is formatted with leading zeros and indicates room / office number. Example: Ports 1-5: RM123 Ports 6-10: RM012
 6. Wireless access points shall be labeled in the same manner as faceplates. ID to be constructed as follows: n-Pxx where "n" is the IDF number, "P" is the patch panel number (A, B, or C), "xx" is the port number on the patch panel formatted with leading zeros. Example 2-A01

(IDF #2, patch panel A, port #01) 3-C24 (IDF #3, patch panel C, port #24)

7. Faceplate ID shall be constructed as follows: n-Pxx-xx where "n" is the IDF number, "P" is the patch panel number (A, B, or C), "xx" is the port number on the patch panel formatted with leading zeros. Example: 2-A01-04 (IDF #2, patch panel A, ports #01-04) 3-C21-24 (IDF #3, patch panel C, port #21-24 MDF is to be n = 1; IDF's are n = 2 or higher
8. Ports on faceplates start with "1" at the top left going in a Z-pattern. Individual port numbering is not required.
9. The labeling shall be delineated on any riser diagrams, floor plans and test reports.
10. The labeling shall be computer software generated and printed with readable fonts and black ink.
11. Each and every cable termination must be labeled, with each and every cable labeled within two (2) inches of each end.
12. Termination labels and cable tags identifying two ends of the same cable must be the same color.
13. All labeling must be securely fastened, either using heat shrink or self-laminating labels and must be machine generated; handwritten labels are not acceptable.
14. Approval of the County's Representative for sample labels of each type must be secured prior to commencing application.

F. Patch Panels:

1. Patch panels will be provided with factory installed label fields.
2. SCCS Contractor installed labels shall identify workstation outlet location and its room number and related patch panel port number.

G. Outlets:

1. Outlets faceplates will be provided with factory installed label field labels.
2. SCCS Contractor installed labels shall identify IDF and its room number and related patch panel port number.

3.12 AS-BUILT DOCUMENTATION (OFOI)

- A. The SCCS Contractor shall provide complete documentation of as-built conditions within ten business days of each SCCS installation completion; late delivery of all submittals (including, but not limited to, as-built documentation) will cause delay of Acceptance by the County. CAD backgrounds shall be provided in electronic form to the County via a media to be mutually determined.

- A. The SCCS Contractor shall provide updated AutoCAD drawings utilizing release 2002 or higher; such drawings will indicate site plans, floor plans, as-built conditions of all outlet locations (including outlet numbering), MDF and IDF areas, as well as main cable runs within the ceiling (including cable pathway apparatus such as cable trays, conduits, sleeves, and trapeze systems).

- B. The SCCS Contractor shall provide for each SCCS installation one (1) "D" size laminated hardcopy plot of each drawing installation drawing set. A laminated copy shall be posted in the MDF.
- C. The SCCS Contractor shall provide for each SCCS installation one (1) "E" size hardcopy plot of each drawing installation drawing set. Copies shall be delivered to County's IT Department within 10 business days of completing the SCCS installation.
- D. As-Built documentation shall be provided to County on a compact disc (CD) or other media as otherwise mutually agreed.

PART 4 SCCS PATHWAYS INSTALLATION

3.13 PATHWAYS

- A. Comply with the County, TIA-569, NEC and CEC standards.
- A. Use of existing signal and other conduit must be approved in advance by the County. The SCCS contractor shall be responsible for all replacement cost for damage to cables currently occupying existing conduits
- B. Conceal interior conduit within finished walls and ceilings where possible.
- C. Keep conduit minimum 6 inches away from parallel runs of electrical power equipment, flues, steam, and hot water pipes.
- D. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit is visible after completion of project.
- E. Run conduits in crawl spaces and under floor slabs as if exposed.
- F. Install no more than two 90-degree bends for a single horizontal cable run.
- G. Run surface raceway as indicated by construction drawings and specifications.
- H. Any transitions between buildings or structures shall include an appropriate liquid tight flex joint with a drip loop.
- I. Provide 18" X 18" X 6", NEMA rated 3R, Pull boxes with liquid tight flex conduit only where flexible connections are required. the County approval required prior to all liquid tight flex conduit installations.
- J. New underground conduit shall be 2", 3" or 4" PVC schedule 40. All sections shall be permanently glued together.

- K. Transition from underground PVC to above ground stub up shall be via rigid conduit and secured to structure via the County approved Unistrut assemblies.
- L. All conduits shall be properly reamed and bushed with pull ropes installed.
- M. Conduits terminating inside of building through floor shall be installed so that the conduit extends a minimum of 4" above finished floor.
- N. Conduits terminating inside of building through ceiling shall be installed so that the conduit extends a minimum of 4" below finished ceiling.
- O. Conduits terminating inside of building through wall shall terminate in appropriately sized junction box.
- P. Empty conduits shall be plugged with mechanical type seals to ensure that foreign matter does not enter the building. All empty conduits shall be equipped with mechanical type seal plugs in all pull boxes, junction boxes and within all buildings.
- Q. All conduits, sleeves and other floor, ceiling and wall penetrations shall be fire-stopped by the SCCS Contractor prior to acceptance. Such fire-stopping shall conform to the County's requirements and shall be implemented in accordance with UL design guidelines for fire-rated assemblies.
- R. Provide all coring, patching and painting as needed for Intra-Building and Inter-Building pathways. Caulking is not an acceptable patching method for conduit penetrations into exterior walls. Coordinate with the County for acceptable patching methods.

3.14 UNDERGROUND PULL BOXES AND JUNCTION BOXES

- A. Underground pull boxes shall be made of concrete and the minimum size shall be 35 ½" x 17 ½" x 12".
- A. Underground pull box covers shall be rated for traffic (type T.05) and shall be marked communications.
- B. Metal covers shall be used in all location subject to vehicle traffic.
- C. Gravel shall be installed below all Underground pull boxes for drainage.
- D. Underground pull boxes and junction boxes shall not be placed in areas subject to flooding.
- E. Establish drainage to meet Public Works Construction Standards (Green Book).
- F. Unless otherwise noted, exterior junction boxes shall have minimum dimensions of 18" x 18" x 6" and have a minimum NEMA rating of 3R.

- G. Interior junction boxes shall consist of 16 gauge steel minimum, unless otherwise noted on plans.
- H. Indoor enclosures shall conform to NEMA Type 4, unless otherwise noted.
- I. Size junction boxes to not less than minimum Code requirements. Increase size above Code requirements where necessary to provide space for pulling, racking or splicing enclosed conductors, or where specified or indicated dimensions exceed Code requirements.
- J. Exterior metal junction boxes exposed to weather (and not installed in or below grade) shall be equipped with rain-tight or weatherproof-hinged doors.
- K. Exterior junction boxes shall have 16 gauge steel bodies and 14 gauge steel doors.
- L. Exterior junction boxes shall be equipped with external mounting feet.
- M. Exterior pull boxes shall be equipped with stainless steel door clamps on three sides and a removable stainless steel continuous hinge pin.
- N. Exterior junction boxes shall be equipped with a hasp and staple for padlocking
- O. Enclosures installed on vertical exterior walls shall conform to NEMA Type 3R.
- P. Enclosures installed on exterior horizontal surfaces such as rooftops or breezeways shall conform to NEMA Type 4 unless otherwise noted.
- Q. Rain tight or weatherproof boxes shall use threaded watertight hubs for top or side entry and may use knockout for bottom entry only.
- R. Exterior pull boxes shall conform to these industry standards:
 - 1. UL 508 Type 4
 - 2. NEMA/EEMAC Type 3, Type 4, Type 12, Type 13
 - 3. JIC standard EGP-1-1967
 - 4. CSA Type 4
 - 5. EC 529, IP66
- S. Tamper resistant screws shall be used on all exterior aboveground junction boxes that are exposed to public/student areas.
- T. Exterior pull boxes shall be manufactured by Hoffman or the County approved equal.

3.15 COMMUNICATION DUCT-BANKS AND CONDUITS

- A. Use of existing signal and other conduit must be approved in advance by the County.

- B. All underground trenches shall be a minimum 24" wide by a minimum of 30" deep.
- C. Trenches shall be back-filled at 95% compaction.
- D. Contractor shall restore surface to same or better condition.
- E. Contractor shall coordinate with the County to verify the location of existing underground utilities.
- F. Modifications to pathway design may be dictated by field conditions subject to approval by the County.
- G. Conduits must be inspected by the County facilities-inspector prior to backfill.
- H. Compaction testing notification must be provided to the County 48 hours prior to testing so that a County inspector may be present.
- I. Slurry fill trenches to within three inches (3") of finished grade whenever crossing paved areas. "Two Sack" slurry shall be used.
- J. Pavement removal and patching shall conform to specifications and standards listed in Public Works Standards (Green Book 2000).
- K. Underground conduit shall consist of Schedule 40 PVC - 2 inch 3 inch or 4 inch inside diameter or type C telephone conduit - 2 inch, 3 inch or 4 inch inside diameter (if concrete encased). Conduit shall transition from schedule 40 to rigid type conduit when rising above grade.
- L. Maximum distances between conduit termination points and/or pull boxes shall be coordinated and approved by the County.
- M. Conduit shall have a factory formed bell on one end for interconnecting segments.
- N. Conduit located under heavy use highways or railroad rights-of-ways shall be encased in steel casing consistent with the AASHTO or AREA specifications. The thickness of the steel casing shall be engineered for each specific application. This may vary based on campus codes.
- O. Spacers: High impact spacers shall be used in all multi-duct systems, for joint telecommunications/power construction. They shall conform to NEMA TC-2, TC-6, TC-8, and ASTM F 512 dimensions.
- P. All fittings shall be designed specifically for use with the type of conduit placed.
- Q. All conduits shall be equipped with mechanical seal plugs in all ground boxes and expansion rubber seal plugs within all buildings.

- R. A horizontal and vertical separation of 1 inch shall be maintained between the ducts by installing high impact spacers with horizontal and vertical locking intervals of ten feet.
- S. All communications conduits shall be placed in a uniform manner between ground boxes and pull boxes. Conduit in position #1 at one ground box or pull box shall maintain its position within the duct run and terminate in the #1 position at the next box. The position of all conduits between ground boxes and pull boxes shall be maintained.
- T. Long radius bends (over 30 feet) shall be used whenever possible to make changes in direction. If it is found to be necessary to place a 90-degree bend in the conduit run, a factory-made sweep of no less than 60-inch radius shall be used.
- U. No conduit run shall exceed a total of 180 degrees of bend between any two points (such as manholes or buildings) considering both vertical and horizontal sweeps.
- V. Cold-formed trench bends shall have a radius of not less than 60 inches and shall pass mandrel integrity. Bend radius criterion is 2" or less 6 times the diameter of the conduit and any conduit larger than 2" is 10 times the diameter of the conduit.
- W. The length and destination of all conduits shall be identified in each ground box, pull box and building. Embossed metal or heavy plastic tags strapped to each conduit shall be used.
- X. After installation of communications conduits, the contractor shall prove all conduits by pulling a mandrel with a diameter $\frac{1}{4}$ inch smaller than the conduit and 6 inches long through each conduit end-to-end. An inspector designated by the contractor and the County shall be notified 24 hours before this procedure. Each conduit shall be cleaned with a bristle brush to remove any debris.
- Y. Utility marking tape shall be buried 18 inches above the conduits.
- Z. Where communications and power conduits occupy the same trench, all conduit structures shall be built with the telecommunications conduits placed above the power conduits and separated by a minimum of 12" of compact earth or 3" of concrete encasement, unless otherwise called out and approved by the County. If this type of construction is required, it shall receive the prior approval of the contractor and the County.
- AA. All conduits shall be equipped with seal plugs in all pull boxes and expansion rubber seal plugs within all junction boxes and building entrances.
- BB. Contractor shall install new $\frac{1}{4}$ " pull rope in all conduits placed.

3.16 CONDUIT

- A. Where overhead and/or surface mounted conduit is required between buildings, Contractor shall utilize GRS conduit with an inside diameter of 2", 3", or 4" as called out by construction documents.
- A. Where concealed, overhead and/or surface mounted conduit is required within buildings, Contractor shall utilize EMT conduit with an inside diameter of 1", 1 1/4", 1 1/2" or 2" as called out by construction documents.
- B. All fittings shall be appropriate type connectors and couplers designed specifically for use with the type of conduit placed.
- C. All fittings shall be watertight. Fitting types shall be pre-approved by the County's representative. Unless pre-approved by the County's representative, all conduits shall be installed by a qualified electrical contractor who has at least five years experience in similar installations within the Southern California area.
- D. Contractor shall install conduit at roof locations utilizing the current County approved methodology and process. Contractor shall utilize GRS conduit on building exteriors. All conduit pathways and locations must be approved by the County prior to installation. All roof penetrations must be approved by the County prior to installation.
- E. All conduits shall be inspected and approved by the County prior to installation of cable
- F. Contractor shall install new 1/4" pull rope in all conduits placed.

3.17 COMMUNICATIONS ENTRANCE CONDUIT

- A. To prevent shear, all inter-building conduit transitions (either underground or aerial) shall transition from PVC or metal to liquidtight conduit when attaching between permanent structures. The contractor and the County shall determine the placement of all entrance conduits. All applicable standards shall be adhered to, i.e., the County, NEC, BICSI or G.O. 128.
- A. Liquidtight flex conduit drip loop lengths shall not exceed 24", unless approved by the County.
- B. Contractor shall install new 1/4" pull rope in all conduits placed.
- C. Transition from underground PVC to above ground stub up shall be via rigid conduit.
- D. Conduits shall be attached to structure utilizing the County approved Unistrut assemblies.
- E. All conduits shall be properly reamed and bushed.

- F. Conduits terminating inside of building through floor shall be installed so that the conduit extends a minimum of 4" above finished floor.
- G. Conduits terminating inside of building through ceiling shall be installed so that the conduit extends a minimum of 4" below finished ceiling.
- H. Conduits terminating inside of building through wall shall terminate in appropriately sized junction box.
- I. Empty conduits shall be plugged with mechanical type seals to ensure that foreign matter does not enter the building.
- J. Provide all coring, patching and painting as needed for Intra-Building and Inter-Building pathways. Caulking is not an acceptable patching method for conduit penetrations into exterior walls. Coordinate with the County for acceptable patching methods.

3.18 DUCT-BANK LOCATING CABLE (ELECTRONICALLY DETECTABLE WARNING TAPE)

- A. Warning tape shall be a minimum of 3" wide, orange in color, and shall have a non-degradable imprint as follows:
 - A. "Caution fiber optic cable buried below"
 - B. The tape shall be electronically detectable.

3.19 PULL ROPE

- A. Pull rope shall be new 1/4" polypropylene over polyester rope with a minimum 1700 lb. Tensile strength.
- A. Pull rope shall be new material that is free of knots, kinks, and abrasions and shall be placed as a single continuous length in every new conduit.
- B. Pull rope shall be secured at each end.

PART 4 - PART 5 MISCELLANEOUS

4.1 MISCELLANEOUS SPECIFICATIONS

- A. General Information: Specifications: The Technical Specifications herein describe the various requirements relating to proper installation of the communications cabling system for this Project. At a minimum, the SCCS Contractor is responsible for ensuring that all requirements of these specifications inclusive of the Technical Specifications are fully met.
- A. Miscellaneous Project Requirements:

1. Ordering of Equipment and Materials: The SCCS Contractor shall be responsible for placing orders for all required materials, components, and supplies. The SCCS Contractor shall also secure and forward to the County's Representative written confirmation (including orders and shipping dates) direct from each manufacturer and supplier. The SCCS Contractor shall expedite shipment of all materials, components and supplies as necessary to ensure the successful completion of each installation by the date required. Expedite charges, if necessary, will be submitted to County for written approval prior to ordering.
2. Implementation Planning and Execution: The SCCS Contractor shall work with the County and the County's Representatives to plan implementation schedules and methodologies to minimize impact to County users or other trades during installation and cutover processes. All costs for planning and coordination as well as for after normal business hours labor shall be included within the SCCS Contractor's proposed pricing. The SCCS Contractor shall note that due to academic and administrative activities implementation may be impacted after normal business hours. SCCS Contractor overtime labor may also be required (without additional cost to the County) only as necessary to ensure compliance with mutually agreed SCCS installation milestones.

END OF SECTION 271343

SECTION 283100 - FIRE DETECTION AND ALARM WITH EMERGENCY VOICE SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes automatic smoke detectors, fire alarm signaling appliances, signal wire and cable, fire alarm control panel, and other components as specified and shown on plans.
- B. Related Sections:
 - 1. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.
 - 2. Section 260526 - Grounding and Bonding for Electrical Systems.
 - 3. Division 23 - Mechanical

1.2 REFERENCES

- A. National Fire Protection Association:
 - 1. NFPA 72 - National Fire Alarm Code.
 - 2. 2013 California Building Code (CBC)
 - 3. 2013 California Electrical Code (CEC)
 - 4. 2013 California Fire Code (CFC)

1.3 SYSTEM DESCRIPTION

- A. Fire Alarm System: NFPA 72, automatic local fire alarm system with new Notifier NFS2 640 control panel with network connection to the existing Notifier NFS 640 control panel, including complete emergency voice system.
- B. Alarm Sequence of Operation: Actuation of initiating device causes the following system operations:
 - 1. Local fire alarm signaling devices (strobes and speakers) sound and display with signal.
 - 2. Non-coded signal transmits to remote central station.
 - 3. Location of alarm zone indicates on fire alarm control panel and on remote annunciator panel.
 - 4. Signal transmits to building mechanical controls, shutting down the specified HVAC units and operating dampers.
- C. Drill Sequence of Operation: Manual drill function causes alarm mode sequence of operation.
- D. Trouble Sequence of Operation: System or circuit trouble causes the following system operations:
 - 1. Visual and audible and amplifier trouble alarm indicates at fire alarm control panel.

2. Visual and audible and amplifier trouble alarm indicates at remote annunciator panel.
3. Trouble signal transmits to remote central station.

1.4 SUBMITTALS

- A. Division 01 – General Requirements: Submittal procedures.
- B. Shop Drawings: Indicate system wiring diagram showing each device and wiring connection; indicate layout, and design calculations.
- C. Product Data: Submit catalog data showing electrical characteristics and connection requirements.
- D. Test Reports: Indicate procedures and results for specified field testing and inspection.
- E. Manufacturer's Field Reports: Indicate activities on site, adverse findings, and recommendations.

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 – General Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of fire alarm equipment.
- C. Operation and Maintenance Data: Submit manufacturer's standard operating and maintenance instructions.

1.6 QUALITY ASSURANCE

- A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with the 2013 editions of: CBC, CEC and CFC.
- B. Perform Work in accordance with NFPA regulations.
- C. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of project.
- B. Installer: Certified fire alarm installer with service facilities within 100 miles of Project.

- C. Design fire alarm under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.

1.8 MAINTENANCE SERVICE

- A. Division 01 – General Requirements: Maintenance service.
- B. Furnish service and maintenance of fire alarm equipment for one year from Date of Substantial Completion.

1.9 EXTRA MATERIALS

- A. Division 01 – General Requirements: Spare parts and maintenance products.
- B. Furnish one of each type of automatic smoke detector without base.

PART 2 - PRODUCTS

2.1 CONTROL PANEL

- A. Manufacturers:
 - 1. Notifier NFS2-640 with LCD-80 Remote Annunciator
- B. Product Description: Modular fire alarm control panel with flush wall-mounted enclosures.
- C. Power supply: Adequate to serve control panel modules, remote detectors, remote annunciators, smoke dampers, relays, and alarm signaling devices. Include battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours followed by alarm mode for 5 minutes.
- D. System Supervision: Component or power supply failure places system in trouble mode.
- E. Initiating Device Circuits: Supervised zone module with alarm and trouble indication; occurrence of single ground or open condition places circuit in trouble mode but does not disable circuit from initiating alarm.
- F. Indicating Appliance Circuits: Supervised signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode but does not disable circuit from signaling alarm.
- G. Auxiliary Relays: Sufficient SPDT auxiliary relay contacts for each detection zone to provide accessory functions specified.

2.2 MAIN FIRE ALARM CONTROL PANEL OR NETWORK NODE:

- A. Main FACP or network node shall be a NOTIFIER Model NFS2-640 and shall contain a microprocessor based Central Processing Unit (CPU) and power supply in an economical space saving single board design. 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, annunciators, and other system controlled devices.

2.3 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. Each network node shall provide, or be capable of 318 intelligent / addressable devices per SLC loop. The Notification Appliance Circuits shall be programmable to Synchronize with System Sensor, Gentex and Wheelock Notification Appliances.
- C. The system shall include a full featured operator interface control and annunciation panel that shall include a backlit Liquid Crystal Display (LCD), individual color coded system status LEDs, and an alphanumeric keypad with easy touch rubber keys for the field programming and control of the fire and gas detection system.
- D. The system shall be programmable, configurable, and expandable in the field without the need for special tools, PROM programmers or PC based programmers. It shall not require replacement of memory ICs to facilitate programming changes.
- E. The system shall allow the programming of any input to activate any output or group of outputs. Systems that have limited programming (such as general alarm), have complicated programming (such as a diode matrix), or require a laptop personal computer are not considered suitable substitutes.
- F. The FACP shall support up to 20 logic equations, including "and," "or," and "not," or time delay equations to be used for advanced programming. Logic equations shall require the use of a PC with a software utility designed for programming.
- G. The FACP or each network node shall provide the following features:
 - 1. Drift compensation to extend detector accuracy over life. Drift compensation shall also include a smoothing feature, allowing transient noise signals to be filtered out.
 - 2. Detector sensitivity test, meeting requirements of NFPA 72.

3. Maintenance alert, with two levels (maintenance alert/maintenance urgent), to warn of excessive smoke detector dirt or dust accumulation.
4. Up to nine sensitivity levels for alarm, selected by detector. The alarm level range shall be 0.5 to 2.35 percent per foot for photoelectric detectors, 0.5 to 2.5 percent per foot for ionization detectors,, 0.5 to 4.0 percent per foot for acclimate detectors and 1.0 to 4.0 percent per foot for multi-criteria (IntelliQuad and IntelliQuad PLUS) detectors. The system shall also support sensitive advanced detection laser detectors with an alarm level range of .02 percent per foot to 2.0 percent per foot. The system shall also include up to nine levels of Pre-alarm, selected by detector, to indicate impending alarms to maintenance personnel.
5. The ability to display or print system reports.
6. Alarm verification, with counters and a trouble indication to alert maintenance personnel when a detector enters verification 20 times.
7. PAS presignal, meeting NFPA 72 requirements.
8. Self optimizing pre-alarm for advanced fire warning, which allows each detector to learn its particular environment and set its prealarm level to just above normal peaks.
9. Cross zoning with the capability of counting: two detectors in alarm, two software zones in alarm, or one smoke detector and one thermal detector.
10. Control-by-time for non-fire operations, with holiday schedules.
11. Day/night automatic adjustment of detector sensitivity.
12. Device blink control for sleeping areas.
13. The FACP shall be capable of coding main panel node notification circuits in March Time (120 PPM), Temporal (NFPA 72 A-2-2.2.2), and California Code. Panel notification circuits (NAC 1,2,3 and 4) shall also support Two-Stage operation, Canadian Dual Stage (3 minutes) and Canadian Dual Stage (5 minutes). Two stage operation shall allow 20 Pulses Per Minute (PPM) on alarm and 120 PPM after 5 minutes or when a second device activates. Canadian Dual stage is the same as Two-Stage except will only switch to second stage by activation of Drill Switch 3 or 5 minute timer. The panel shall also provide a coding option that will synchronize specific strobe lights designed to accept a specific "sync pulse."
14. Network Communication: The FACP shall be capable of communicating with a Distributed Control System
15. For flexibility and to ensure program validity, an optional Windows(TM) based program utility shall be available. This program shall be used to off-line program the system with batch upload/download, and have the ability to upgrade the manufacturers (FLASH) system code changes. This program shall also have a verification utility, which scans the program files, identifying possible errors. It shall also have the ability to compare old program files to new ones, identifying differences in the two files to allow complete testing of any system operating changes. This shall be in compliance with the NFPA 72 requirements for testing after system modification.
 - a. This utility shall provide the ability to create and print NFPA style Test and Inspection reports

- b. This utility shall provide the ability to create and print Device Maintenance information
 - 16. The 80-character display keypad shall be an easy to use QWERTY type keypad, similar to a PC keyboard. This shall be part of the standard system and have the capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels shall be provided to prevent unauthorized system control or programming.
 - 17. When configured with an optional 640-character display the display shall use 10 "soft" keys for screen navigation or to accomplish dedicated programming functions. Full programming access shall require use of a laptop and the proper programming utility. With the 640 display option the system shall support distributed audio amplifiers on the digital audio loop of the Digital Voice Command.
- H. Signaling Line Circuits (SLC)
 - 1. Each FACP or FACP network node shall support up to two SLCs. Each SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric, multi-criteria, thermal, laser, fire/CO) and 159 intelligent modules (monitor, control, relay, releasing) for a loop capacity of 318 devices. The addition of the optional second loop shall double the device capacity, supporting a total of 636 devices. Each SLC shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
 - 2. CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, prealarm, or trouble conditions exist for each detector. The software shall 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 shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.
- I. Serial Interfaces
 - 1. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Information Technology Equipment (ITE) peripherals.
 - a. EIA-232 interface shall be used to connect an UL-Listed 40 or 80 column printer. Printers that are not UL-Listed are not considered acceptable substitutes.
 - b. The system shall include an EIA-485 port for the serial connection of optional annunciators and remote LCD displays.
 - c. The EIA-485 interface may be used for network connection to a proprietary-receiving unit.
- J. 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. The DVC shall support up to 8 channels of voice when configured with Digital Audio Amplifiers and 4 channels of voice when employing the optional analog output card. Each DVC shall support up to 32 digital audio amplifiers.

2. Function: The Voice Command Center equipment shall perform the following functions:
 - a. Operate as a supervised multi-channel emergency voice communication system.
 - b. Operate as a two-way emergency telephone system control center.
 - c. Audibly and visually annunciate the active or trouble condition of every speaker circuit and emergency telephone circuit.
 - d. Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.
 - e. Provide all-call Emergency Paging activities through activation of a single control switch.
 - f. As required, provide vectored paging control to specific audio zones via dedicated control switches.
 - g. 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.
 - h. 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.
 - i. 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.
 - j. 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.
 - k. The Digital Voice Command and associated equipment shall be protected against unusually high voltage surges or line transients.
3. The emergency voice alarm communication system shall incorporate a Two-way emergency telephone communication system.
 - a. Two-way emergency telephone communication circuits shall be supervised for open and short circuit conditions.
 - b. Two-way emergency telephone (Fire Fighter Telephone) communication shall be supported between the Digital Voice Audio Command Center and up to seven (7) remote Fire Fighter's Telephone locations simultaneously on a telephone riser.

- c. 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.

K. Audio Amplifiers

1. The Audio Amplifiers will provide Audio Power (@25 Volt RMS or 70 RMS) 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. 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.
3. Point Disable: Any addressable device in the system may be enabled or disabled through the system keypad.
4. Point Read: The system shall be able to display or print the following point status diagnostic functions:
 - a. Device status
 - b. Device type
 - c. Custom device label
 - d. View analog detector values
 - e. Device zone assignments
5. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 800 events. Up to 200 events shall be dedicated to alarm and the remaining events are general purpose. Systems that do not have dedicated alarm storage, where events are overridden by non-alarm type events, are not suitable substitutes. Each of these activations will be stored and time and date stamped with the actual time of the activation. The contents of the history buffer may be manually reviewed, one event at a time, or printed in its entirety. The history buffer shall use non-volatile memory. Systems that use volatile memory for history storage are not acceptable substitutes.
6. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is above or below normal limits, then the system will enter the trouble mode, and the particular detector will be annunciated on the system display, and printed on the optional 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.
7. Pre-Alarm Function: The system shall provide two levels of pre-alarm warning to give advance notice of a possible fire situation. Both pre-alarm levels shall be fully field adjustable. The first level shall give an audible indication at the panel. The second level shall give an audible indication and may also activate control relays. The system shall also have the ability to activate local detector sounder bases at the pre-alarm level, to assist in avoiding nuisance alarms.
8. Software Zones: The FACP shall support 142 independent programmable software zones
9. The fire alarm control panel shall include a walk test feature. It shall include the ability to test initiating device circuits and notification

appliance circuits from the field without returning to the panel to reset the system. Operation shall be as follows:

- a. Alarming an initiating device shall activate programmed outputs, which are selected to participate in walk test, for 3 seconds.
 - b. Introducing a trouble into the initiating device shall activate the programmed outputs for 8 seconds.
 - c. All devices tested in walk test shall be recorded in the history buffer.
10. 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.
 11. 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.
- O. 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.
- P. 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.
- Q. 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.
- R. Portable Emergency Telephone Handset Jack
1. Portable emergency telephone handset jacks shall be flush mounted on stainless steel plates as indicated on the plans. Jacks shall be approved for emergency telephone system application.
 2. Insertion of a portable 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.
- S. Fixed Emergency Telephone Handset

1. The telephone cabinet shall be painted red and clearly labeled as "Emergency Telephone." The cabinets shall be located where shown on drawings.
 2. The handset cradle shall have a switch connection so 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. On activating the remote phone, the phone earpiece shall sound a telephone ring signal until the master handset is lifted.
 4. The two-way emergency telephone system shall support a minimum of seven (7) handsets on line without degradation of the signal.
- T. All interfaces and associated equipment are to be protected so that they will not be affected by voltage surges or line transients consistent with UL standard 864.
- U. Communicators
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.

The UDACT shall be capable of transmitting events in 4+2, SIA, and Contact ID.

Communication shall include vital system status such as:
 - a. Independent Zone (Alarm, trouble, non-alarm, supervisory)
 - b. Independent Addressable Device Status
 - c. AC (Mains) Power Loss
 - d. Low Battery and Earth Fault
 - e. System Off Normal
 - f. 12 and 24 Hour Test Signal
 - g. Abnormal Test Signal (per UL requirements)
 - h. EIA-485 Communications Failure
 - i. Phone Line Failure
 3. 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.
 4. 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.

5. The UDACT shall be capable of generating Central Station reports providing detailed programming information for each point along with the central station point address.
 6. 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.
- V. 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 CEILING SMOKE DETECTOR

A. Manufacturers:

1. Notifier FSP 851 with base.
2. Substitutions: Not Permitted.

B. Product Description: NFPA 72, photoelectric type ceiling smoke detector with the following features:

1. Adjustable sensitivity.
2. Plug-in base.
3. Auxiliary relay contact.
4. Integral thermal element rated 135 degrees F.
5. Visual indication of detector actuation.
6. Comply with UL 268.

- C. Mounting: 4 inch outlet box.
- D. Furnish power supply and signal circuits.

2.5 HEAT DETECTOR (WHERE APPLICABLE)

- A. Manufacturers:
 - 1. Notifier FST 851H with base.
 - 2. Substitutions: Not permitted.

2.6 ALARM SPEAKER-STROBE

- A. Manufacturers:
 - 1. System Sensor SPS
 - 2. Substitutions: Not Permitted.
- B. Product Settings:
 - 1. Set tap at wattages shown on plans.

2.7 ALARM STROBE

- A. Manufacturers:
 - 1. Notifier SR
 - 2. Substitutions: Not Permitted.
- B. Product Description: NFPA 72, strobe lamp and flasher with red lettered "FIRE" on white lens.

2.8 ALARM SPEAKER

- A. Manufacturers:
 - 1. System Sensor, SPRK
 - 2. Substitutions: Not Permitted.
- B. Product Description: Exterior mounted horn with the following features:
 - 1. Set tap at wattages shown on plans.

2.9 WIRE AND CABLE

- A. Manufacturers:
 - 1. Comtran Cable, Vitalink 35787.
 - 2. Westpenn.
 - 3. Anixter.
 - 4. Substitutions: Not Permitted.
- B. Product Description: 2-hour fire resistive circuit integrity (CI) type FPLR cable, meeting Level 2 survivability requirements.
- C. Fire alarm circuit conductors have insulation color or code as follows:

1. Power Branch Circuit Conductors: Black, red, white.
2. Initiating Device Circuit: Black, red.
3. Detector Power Supply: Violet, brown.
4. Signal Device Circuit: Blue (positive), white (negative).

2.10 OTHER COMPONENTS

- A. As identified in drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 – General Requirements: Coordination and project conditions.
- B. Verify products and systems receiving devices are ready for installation.

3.2 INSTALLATION

- A. Install audible and visual signal devices per drawing details.
- B. Install 16 AWG minimum size conductors for fire alarm detection and signal circuit conductors in conduit.
- C. Mount end-of-line device in control panel box with last device or separate box adjacent to last device in circuit.
- D. Automatic Detector Installation: Conform to NFPA 72.
- E. Install engraved plastic nameplates in accordance with Section 260553.
- F. Ground and bond fire alarm equipment and circuits in accordance with Section 260526.

3.3 FIELD QUALITY CONTROL

- A. Division 01 – General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Test in accordance with NFPA 72 and local fire department requirements.

3.4 MANUFACTURER'S FIELD SERVICES

- A. Division 01 – General Requirements: Manufacturer's field services.
- B. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

3.5 DEMONSTRATION AND TRAINING

- A. Furnish 2 hours of instruction each for two persons, to be conducted at project site with manufacturer's representative.

END OF SECTION 283100

SECTION 310513 - SOILS FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Subsoil materials.
 - 2. Topsoil materials.
- B. Related Requirements:
 - 1. Division 31- Earthwork.
 - 2. Division 32- Exterior Improvements.

1.2 UNIT PRICES - MEASUREMENT AND PAYMENT

- A. Subsoil:
 - 1. Basis of Measurement: By yard.
 - 2. Basis of Payment: Includes excavating existing subsoil, supplying subsoil materials, stockpiling.
- B. Topsoil:
 - 1. Basis of Measurement: By yard.
 - 2. Basis of Payment: Includes excavating existing topsoil, supplying topsoil materials, stockpiling.

1.3 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
 - 1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³).
 - 2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).
 - 3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

1.4 SUBMITTALS

- A. Division 01- General Requirements: Requirements for submittals.
- B. Samples: Submit, in air-tight containers, 10 lb sample of each type of fill to testing laboratory.

- C. Materials Source: Submit name of imported materials source.
- D. Manufacturer's Certificate: Certify meet or exceed specified requirements.

1.5 SUSTAINABLE DESIGN SUBMITTALS

- A. Division 01- General Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
 - 1. Materials Resources Certificates:
 - a. Certify source for regional materials and distance from Project site.
- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
 - 1. Provide cost data for the following products:
 - a. Regional products.

1.6 QUALITY ASSURANCE

- A. Furnish each subsoil and/or topsoil material from single source throughout the Work.
- B. Perform Work in accordance with County of San Bernardino Public Work's standard.
- C. Maintain one copy on site.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Division 01- General Requirements: Requirements for sustainable design compliance.
- B. Materials and Resources Characteristics:
 - 1. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project.

2.2 SUBSOIL MATERIALS

- A. Subsoil Type S1: Conforming to Standard Specifications for Public Works Standards (SSPWC) (Greenbook).

- B. Subsoil Type S2:
 - 1. Excavated and re-used material.
 - 2. Graded.
 - 3. Free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
 - 4. Conforming to ASTM D2487.

2.3 TOPSOIL MATERIALS

- A. Topsoil Type S3: Conforming to SSPWC (Greenbook).
- B. Topsoil Type S4:
 - 1. Excavated and reused material.
 - 2. Graded.
 - 3. Free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds and foreign matter.
 - a. Screening: Double screened.
- C. Topsoil Type S5:
 - 1. Imported borrow.
 - 2. Friable loam.
 - 3. Reasonably free of roots, rocks larger than 1/2, subsoil, debris, large weeds, and foreign matter.
 - a. Screening: Double screened.
 - 4. Acidity range (pH) of 5.5 to 7.2.
 - 5. Containing minimum of 4 percent and maximum of 25 percent inorganic matter.

2.4 SOURCE QUALITY CONTROL

- A. Division 01- General Requirements: Testing and Inspection Services Testing and analysis of soil material.
- B. Testing and Analysis of Subsoil Material: Perform in accordance with ASTM D698 and ASTM D1557.
- C. Testing and Analysis of Topsoil Material: Perform in accordance with ASTM D698 and ASTM D1557.
- D. When tests indicate materials do not meet specified requirements, change material and retest.
- E. Furnish materials of each type from same source throughout the Work.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Excavate topsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas.
- B. Stockpile excavated material meeting requirements for topsoil materials.
- C. Remove excess excavated and topsoil not intended for reuse, from site.
- D. Remove excavated materials not meeting requirements for subsoil materials and topsoil materials from site.

3.2 STOCKPILING

- A. Stockpile materials on site at locations indicated designated by Architect/Engineer.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Stockpile topsoil 4 feet high maximum.
- E. Prevent intermixing of soil types or contamination.
- F. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
- G. Stockpile unsuitable materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION 310513

SECTION 310516 - AGGREGATES FOR EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Coarse aggregate materials.
 - 2. Fine aggregate materials.
- B. Related Requirements:
 - 1. Division 31- Earthwork.
 - 2. Division 32- Exterior Improvements.
 - 3. Division 33- Utilities.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Aggregate:
 - 1. Basis of Measurement: By cubic yard.
 - 2. Basis of Payment: Includes supplying aggregate materials, stockpiling.

1.3 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
 - 2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
 - 1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - 5. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.4 SUBMITTALS

- A. Division 01- General Requirements: Requirements for submittals.

- B. Samples: Submit, in air-tight containers, 10 lb sample of each type of fill to testing laboratory.
- C. Materials Source: Submit name of imported materials suppliers.
- D. Manufacturer's Certificate: Certify Products meet or exceed.

1.5 SUSTAINABLE DESIGN SUBMITTALS

- A. Division 01- General Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
 - 1. Materials Resources Certificates:
 - a. Certify source for regional materials and distance from Project site.
 - b. Certify recycled material content for recycled content products.
- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
 - 1. Provide cost data for the following products:
 - a. Regional products.
 - b. Products with recycled material content.

1.6 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.
- B. Perform Work in accordance with Standard Specifications for Public Works Construction (SSPWC) (Greenbook).
- C. Maintain one copy of each document on site.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Division 01- General Requirements: Requirements for sustainable design compliance.
- B. Materials and Resources Characteristics:
 - 1. Recycled Content Materials: Furnish materials with maximum available recycled content including:
 - a. Crushed Asphalt pavement, Crushed concrete.

2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project site.

2.2 COARSE AGGREGATE MATERIALS

- A. Coarse Aggregate Type A1: Conforming to SSPWC (Greenbook).
- B. Coarse Aggregate Type A2 (Gravel): SSPWC (Greenbook).
- C. Coarse Aggregate Type Crushed Gravel: Angular crushed per SSPWC (Greenbook), in accordance with ASTM D2487.

2.3 FINE AGGREGATE MATERIALS

- A. Fine Aggregate Type: Conforming to SSPWC (Greenbook).

2.4 SOURCE QUALITY CONTROL

- A. Division 01- General Requirements: Testing and inspection services.
- B. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D1557.
- C. Fine Aggregate Material - Testing and Analysis: Perform in accordance with ASTM D1557.
- D. When tests indicate materials do not meet specified requirements, change material and retest.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Excavate aggregate materials from on-site locations as specified in Division 31- Earthwork.
- B. Stockpile excavated material meeting requirements for coarse aggregate materials and fine aggregate materials.
- C. Remove excess excavated materials, coarse aggregate materials not intended for reuse, from site.
- D. Remove excavated materials not meeting requirements for coarse aggregate materials and fine aggregate materials from site.

3.2 STOCKPILING

- A. Stockpile materials on site if needed.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.
- D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
- E. Stockpile unsuitable and/or hazardous materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION 310516

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above-and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing/abandoning site utilities.

B. Related Requirements:

1. Division 01- General Requirements: for temporary utility services, construction and support facilities, security and protection facilities, and temporary erosion/sedimentation and storm water pollution control measures.

1.2 DEFINITIONS

- A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.
- D. Tree-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.3 MATERIAL OWNERSHIP

- A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.4 INFORMATIONAL SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
 - 1. Use sufficiently detailed photographs or videotape.
 - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
- B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions. Provide copy to Engineer of Record.

1.5 QUALITY ASSURANCE

- A. Pre-installation Conference: Conduct conference at project site.

1.6 PROJECT CONDITIONS

- A. Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.
 - 1. Protect improvements on adjoining properties, public right-of-way and on Owner's property.
 - 2. Restore damaged improvements to their original condition, as acceptable to property owners. The full width of pavements damaged due to construction access and other construction-related activities shall be replaced with a structural section (pavement and base) at least equal to the adjacent existing section.
 - 3. Protect existing utility lines indicated to remain. Notify Architect immediately of any damage to or encounter with an unknown existing utility line. Immediately repair damage to existing utility lines.
- B. Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction

materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.

1. Repair or replace trees and vegetation indicated to remain that are damaged by Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations.
 2. Provide protection for roots over 1-1/2 inch in diameter that are cut during construction operations. Coat cut faces with emulsified asphalt or other acceptable coating formulated to use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.
 3. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations in a manner acceptable to Architect. Employ a licensed arborist to repair damage to trees and shrubs.
 4. Replace trees that cannot be repaired and restored to full-growth status, as determined by arborist.
- C. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- D. Improvements on Adjoining Property: no work shall be performed on adjoining property.
1. Contractor shall delineate the property line with construction stakes.
 2. Contractor shall document the pre-construction condition and photograph the existing conditions.
 3. Do not proceed with work on adjoining property unless directed by Architect.
- E. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises per owner's direction.

- F. Utility Locator Service: Notify UNDERGROUND SERVICE ALERT for area where Project is located before site clearing.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31- Earthwork.
1. Obtain approved of borrow soil material from off-site when satisfactory soil material is not available on-site
- B. Tree Wound Paint: Bituminous based paint of standard manufacture specially formulated for the intended use.

PART 3 - EXECUTION

3.1 SITE CLEARING

- A. Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions, as required, to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. Removal includes digging out and off-site disposal of stumps and roots.
1. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 2. Unless specifically designated to remain, strip the upper two inches (minimum) of soil containing vegetation and root growth within the Limits of Work shown on the Drawings.
- B. Removal of Improvements: Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction.
1. Abandonment or removal of certain underground pipe or conduits may be indicated on mechanical or electrical drawings. Removing abandoned underground piping or conduits interfering with construction is included under this Section.
 2. Contractor shall refer to the project's Asbestos Abatement Report for removal of asbestos containing materials and other potential hazardous materials

- C. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except for those indicated to be left standing.
1. Completely remove stumps, roots, and other debris protruding through ground surface.
 2. Use only hand methods for grubbing inside drip line of trees indicated to remain.
 3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
 - a. Place fill material in horizontal layers not exceeding 6 to 8 inch loose depth, and thoroughly compact each layer in accordance with the requirements specified in Division 31- Earthwork to make the new surface conform with the existing adjacent surface of the ground.
 4. Trim trees, designated to be left standing within the cleared areas, of dead branches 1-1/2 inches or more in diameter; and trim all branches to heights and in a manner as indicated. Neatly cut limbs and branches to be trimmed close to the bole of the tree or main branches. Paint cuts more than 1-1/4 inches in diameter with specified tree-wound paint.
- D. Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other objectionable material.
1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping.
 - a. Where existing trees are indicated to remain, leave existing topsoil in place within drip lines to prevent damage to root system.
 2. Stockpile topsoil in storage piles in areas indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles, if required, to prevent wind and sediment erosion.
 3. Dispose of unsuitable or excess topsoil as specified for disposal of waste material.
- E. Protect and maintain benchmarks and survey control points from disturbance during construction.

- F. Locate and clearly identify trees, shrubs, and other vegetation to remain.

3.2 EXISTING UTILITIES

- A. Arrange with Owner for disconnecting and sealing of all overhead and underground utilities that serve adjoining existing structures before site clearing
 - 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap utilities indicated to be abandoned in place.
 - 1. Arrange with utility companies to shut off indicated utilities.
 - 2. Arrange with owner scheduling of utilities shut off.
- C. Locate, identify, and disconnect utilities indicated to be removed.
- D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Architect's written permission.
- E. Excavate for and remove underground utilities indicated to be removed.
- F. Contractor shall note that various unknown and undocumented underground utilities exist at the project site. Contractor shall ensure that utilities are inactive or shut off prior to removal or abandonment. Contractor shall document all found underground utilities and notify engineer of record for further direction.

3.3 SITE IMPROVEMENTS

- A. Remove existing above-and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.

2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.4 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

NOT FOR BID

SECTION 312213 - ROUGH GRADING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavating topsoil.
 - 2. Excavating subsoil.
 - 3. Cutting, grading, filling, compacting, site structures, and building pads.
- B. Related Sections:
 - 1. Division 02- Existing Conditions.
 - 2. Division 31- Earthwork.
 - 3. Division 32- Exterior Improvements.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Topsoil Fill:
 - 1. Basis of Measurement: By cubic yard.
- B. Subsoil Fill Type:
 - 1. Basis of Measurement: By the cubic yard.
- C. Structural Fill Type:
 - 1. Basis of Measurement: By the cubic yard.

1.3 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
 - 1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³).
 - 3. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 - 4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).
 - 5. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 - 6. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

7. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).
8. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
9. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

C. Standard Specifications for Public Works Construction (Greenbook) (SSPWC).

1.4 SUBMITTALS

- A. Division 01- General Requirements: Requirements for submittals.
- B. Samples: Submit, in air-tight containers, 10 lb sample of each type of fill to testing laboratory.
- C. Materials Source: Submit name of imported materials suppliers.

1.5 SUSTAINABLE DESIGN SUBMITTALS

- A. Division 01- General Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
 1. Materials Resources Certificates:
 - a. Certify recycled material content for recycled content products.
 - b. Certify source for regional materials and distance from Project site.
- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
 1. Provide cost data for the following products:
 - a. Products with recycled material content.
 - b. Regional products.

1.6 CLOSEOUT SUBMITTALS

- A. Division 01- General Requirements: Requirements for submittals.
- B. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C136.

- B. Perform Work in accordance with SSPWC (Greenbook).
- C. Maintain one copy of each document on site.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Division 01- General Requirements: Requirements for sustainable design compliance.
- B. Materials and Resources Characteristics:
 - 1. Recycled Content Materials: Furnish materials with maximum available recycled content [including:]
 - a. Crushed Asphalt and/or Concrete.

2.2 MATERIALS

- A. Topsoil: as specified in Division 31- Earthwork.
- B. Subsoil Fill: as specified in Division 31- Earthwork.
- C. Structural Fill: as specified in Division 31- Earthwork.
- D. Granular Fill: as specified in Division 31- Earthwork.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01- General Requirements: Verification of existing conditions before starting work.
- B. Verify site conditions under provisions of Division 01- General Requirements.
- C. Verify survey bench mark and intended elevations for the Work are as indicated on Drawings.

3.2 PREPARATION

- A. Call Local Utility Line Information service at not less than three working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours, and datum.

- C. Notify utility companies to remove and relocate utilities.
- D. Protect utilities indicated to remain from damage.
- E. Protect plant life, lawns and other features remaining as portion of final landscaping.
- F. Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated, re-landscaped, or regraded, without mixing with foreign materials for use in finish grading.
- B. Do not excavate wet topsoil.
- C. Stockpile in area designated on site to depth not exceeding 4 feet and protect from erosion. Stockpile material on impervious material and cover over with same material, until disposal.

3.4 SUBSOIL EXCAVATION

- A. Excavate subsoil from areas to be further excavated, re-landscaped, or regraded.
- B. Excavate and process wet material to obtain optimum moisture content.
- C. When excavating through roots, perform Work by hand and cut roots with sharp axe.
- D. Remove excess subsoil not intended for reuse, from site.
- E. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key placed fill material to slope to provide firm bearing.
- F. Stability: Replace damaged or displaced subsoil as specified for fill.

3.5 FILLING

- A. Fill areas to contours and elevations with unfrozen materials.
- B. Place fill material in continuous layers and compact [in accordance with schedule at end of this section].
- C. Maintain optimum moisture content of fill materials to attain required compaction density.

- D. Slope grade away from building minimum 5 percent slope for minimum distance of 10 ft, unless noted otherwise.
- E. Make grade changes gradual. Blend slope into level areas.
- F. Repair or replace items indicated to remain damaged by excavation or filling.

3.6 TOLERANCES

- A. Division 01- General Requirements: Tolerances.
- B. Top Surface of Subgrade: Plus or minus 1/10 foot from required elevation.

3.7 FIELD QUALITY CONTROL

- A. Division 01- General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Perform laboratory material tests in accordance with ASTM D1557.
- C. Perform in place compaction tests in accordance with the following:
 - 1. Density Tests: ASTM D1556.
 - 2. Moisture Tests: ASTM D3017.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- E. Frequency of Tests: One (1) Test/2000 sf, or three (3) tests minimum under building pad.

3.8 SCHEDULES

- A. Structural Fill:
 - 1. Compact uniformly to minimum 95 percent of maximum density.
- B. Previous Structural Fill:
 - 1. Compact uniformly to minimum 95 percent of maximum density.
- C. Subsoil Fill:
 - 1. Compact uniformly to minimum 90 percent of maximum density.
- D. Topsoil Fill:
 - 1. Compact uniformly to minimum 95 percent of maximum density.

END OF SECTION 312213

NOT FOR BID

SECTION 312316 - EXCAVATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Soil densification.
 - 2. Excavating for building foundations.
 - 3. Excavating for paving and parking areas.
 - 4. Excavating for slabs-on-grade.
 - 5. Excavating for site structures.
- B. Related Requirements:
 - 1. Division 26- Electrical.
 - 2. Division 31- Earthwork.
 - 3. Division 33- Utilities.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Excavating Soil Materials:
 - 1. Basis of Measurement: By cubic foot yard.
 - 2. Basis of Payment: Includes general excavating to required elevations, loading and placing materials in stockpile or removing from site. Over Excavating: Payment will not be made for over excavated work nor for replacement materials.

1.3 REFERENCES

- A. Local utility standards when working within 24 inches of utility lines.

1.4 SUBMITTALS

- A. Division 01- General Requirements: Requirements for submittals.
- B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.
- C. Shop Drawings: Indicate soil densification grid for each size and configuration footing requiring soils densification.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with SSPWC (Greenbook).
- B. Maintain one copy copies of each document on site.

1.6 QUALIFICATIONS

- A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of California.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Call Local Utility Line Information service at not less than three working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours, and datum.
- C. Notify utility companies to remove and relocate utilities.
- D. Protect utilities indicated to remain from damage.
- E. Protect plant life, lawns, rock outcroppings and other features remaining as portion of final landscaping.
- F. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.2 SOIL DENSIFICATION - VIBRO-COMPACTION

- A. Vibro-compact substrates below footing bearing surfaces for footings as indicated on Drawings before excavating site.
- B. Densify existing subsoils with relative density rating of compact to dense to attain relative density rating of very dense.
 - 1. Densify subsoils to depth of 20 feet.
- C. Densification Equipment:
 - 1. Depth Vibrator: Poker type with follower tubes with visible marking every 12-inches to enable insertion depth measurement.
 - 2. Motion: radial in horizontal plane.
- D. Perform densification in presence of Geotechnical Engineer directly under each footing with vibrator inserted in grid pattern at maximum 6 feet on center.

1. Arrange compaction grid for each footing for maximum number of insertion points and with outermost insertion points within the bearing area of footings.
 2. Adjust compaction grid arrangement and spacing as directed by Geotechnical Engineer to achieve required densification.
- E. Insert vibrator to maximum specified depth. Densify soils for 30 seconds or other time as directed by Geotechnical Engineer. Withdraw vibrator every 12-inches increments and repeat densification at each increment.
1. When subsurface obstruction prevents vibrator insertion to specified depth, request instructions from Geotechnical Engineer to compensate for obstruction.
- F. Tolerances:
1. Maximum Deviation from Center of Completed Compaction: 8 inches from indicated position.
 2. Maximum Deviation from Vertical: 4 degrees during vibrator insertion.

3.3 EXCAVATION

- A. Underpin adjacent structures which may be damaged by excavation work.
- B. Excavate subsoil to accommodate building foundations, slabs-on-grade paving and site structures, and construction operations.
- C. Excavate to working elevation for piling work.
- D. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Division 31- Earthwork.
- E. Slope banks with machine.
- F. Do not interfere with 45 degree bearing splay of foundations.
- G. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- H. Trim excavation. Remove loose matter.
- I. Remove lumped subsoil, boulders, and rock up to 8-inch diameter. Remove all larger material.
- J. Notify Architect/Engineer of unexpected subsurface conditions.
- K. Correct areas over excavated with structural fill as directed by Architect/Engineer.
- L. Remove excess and unsuitable material from site.

- M. Repair or replace items indicated to remain damaged by excavation.

3.4 FIELD QUALITY CONTROL

- A. Division 01- General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Perform inspection of excavation and controlled fill operations in accordance with applicable grading code.
- C. Request visual inspection of bearing surfaces by inspection agency before installing subsequent work.

3.5 PROTECTION

- A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION 312316

SECTION 312317 - TRENCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavating trenches for utilities from 5 feet outside building to utility service.
 - 2. Compacted fill from top of utility bedding to subgrade elevations.
 - 3. Backfilling and compaction.
- B. Related Requirements:
 - 1. Division 03- Concrete.
 - 2. Division 31- Earthwork.
 - 3. Division 32- Exterior Improvements.
 - 4. Division 33- Utilities.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Trenching:
 - 1. Basis of Measurement: By cubic yard.
 - 2. Basis of Payment: Includes excavating to required elevations, protecting excavation, and removing excavated materials from site. Over Excavating: Payment is not made for over excavated work nor for replacement materials.
- B. Subsoil Fill:
 - 1. Basis of Measurement: By cubic yard.
 - 2. Basis of Payment: Includes furnishing fill material, scarifying substrate surface, placing where required, and compacting.
- C. Structural Fill:
 - 1. Basis of Measurement: By cubic yard.
 - 2. Basis of Payment: Includes furnishing fill material, shaping substrate surface, placing where required, and compacting.
- D. Granular Fill:
 - 1. Basis of Measurement: By yard.
 - 2. Basis of Payment: Includes furnishing fill material, scarifying substrate surface, placing where required, and compacting.
- E. Concrete Fill:
 - 1. Basis of Measurement: By cubic yard.
 - 2. Basis of Payment: Includes furnishing materials, forming, mixing and placing where required, and curing.

1.3 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
 - 1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³).
 - 2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 - 3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).
 - 4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 - 5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.4 DEFINITIONS

- A. Utility: Any buried pipe, duct, conduit, or cable.

1.5 SUBMITTALS

- A. Division 01- General Requirements: Requirements for submittals.
- B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.
- C. Product Data: Submit data for geotextile fabric indicating fabric and construction.
- D. Samples: Submit, in air-tight containers, 10 lb sample of each type of fill to testing laboratory.
- E. Materials Source: Submit name of imported fill materials suppliers.

1.6 SUSTAINABLE DESIGN SUBMITTALS

- A. Division 01- General Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
 - 1. Materials Resources Certificates:
 - a. Certify recycled material content for recycled content products.

- b. Certify source for regional materials and distance from Project site.
 - C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
 - 1. Provide cost data for the following products:
 - a. Products with recycled material content.
 - b. Regional products.
- 1.7 QUALITY ASSURANCE
 - A. Perform Work in accordance with Standard Specifications for Public Works Construction (SSPWC) (Greenbook).
 - B. Maintain one copy of each document on site.
- 1.8 QUALIFICATIONS
 - A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of California.
- 1.9 FIELD MEASUREMENTS
 - A. Verify field measurements prior to fabrication.
- 1.10 COORDINATION
 - A. Division 01- General Requirements: Coordination and project conditions.
 - B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

- A. Subsoil Fill: as specified in SSPWC (Greenbook).
- B. Structural Fill: as specified in SSPWC (Greenbook).
- C. Granular Fill: as specified in SSPWC (Greenbook).
- D. Concrete: Lean concrete as in accordance with SSPWC (Greenbook).

2.2 ACCESSORIES

- A. Geotextile Fabric: Non-biodegradable, woven.
 - 1. Alkzo Nobel Geosynthetic Co.
 - 2. Huesker, Inc.
 - 3. TC Mirafi
 - 4. Tenax Corp.
 - 5. Tensar Earth Technologies, Inc.

PART 3 - EXECUTION

3.1 SUSTAINABILITY CHARACTERISTICS

- A. Division 01- General Requirements: Requirements for sustainable design compliance.
- B. Materials and Resources Characteristics:
 - 1. Recycled Content Materials: Furnish materials with maximum available recycled content including:
 - a. Crushed Asphalt and/or Concrete.
 - 2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project site.

3.2 LINES AND GRADES

- A. Lay pipes to lines and grades indicated on Drawings.
 - 1. Architect/Engineer or Owner reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.
- B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.3 PREPARATION

- A. Call Local Utility Line Information service not less than three working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours, and datum locations.
- C. Protect plant life, lawns and other features remaining as portion of final landscaping.
- D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

- E. Maintain and protect above and below grade utilities indicated to remain.
- F. Establish temporary traffic control when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.4 TRENCHING

- A. Excavate subsoil required for utilities to utility service.
- B. Remove lumped subsoil, boulders, and rock up of 6 inch. Remove larger material.
- C. Perform excavation within 24 inches of existing utility service in accordance with utility's requirements.
- D. Do not advance open trench more than 200 feet ahead of installed pipe.
- E. Cut trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Work.
- F. Excavate bottom of trenches maximum 2 feet wider than outside diameter of pipe.
- G. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe utilities.
- H. Do not interfere with 45 degree bearing splay of foundations.
- I. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this section.
- J. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Architect/Engineer.
- K. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Fill Type and compact to density equal to or greater than requirements for subsequent backfill material.
- L. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.
- M. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Architect/Engineer.
- N. Remove excess subsoil not intended for reuse, from site.

3.5 SHEETING AND SHORING

- A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.
- B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.
- C. Design sheeting and shoring to be removed at completion of excavation work.
- D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.
- E. Repair damage to existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.6 BACKFILLING

- A. Backfill trenches to contours and elevations with unfrozen fill materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Place fill material in continuous layers and compact.
- D. Employ placement method that does not disturb or damage foundation perimeter drainage and utilities in trench.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Do not leave more than 50 feet of trench open at end of working day.
- G. Protect open trench to prevent danger to Owner and/or the public.

3.7 TOLERANCES

- A. Division 01- General Requirements: Tolerances.
- B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.
- C. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.8 FIELD QUALITY CONTROL

- A. Division 01- General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Perform laboratory material tests in accordance with ASTM D1557.
- C. Perform in place compaction tests in accordance with the following:
 - 1. Density Tests: ASTM D1556.
 - 2. Moisture Tests: ASTM D3017.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.
- E. Frequency of Tests: 1 test / 100 LF trench. 2 tests minimum.

3.9 PROTECTION OF FINISHED WORK

- A. Division 01- General Requirements: Protecting finished work.
- B. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION 312317

NOT FOR BID

SECTION 312323 - FILL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Backfilling building perimeter to subgrade elevations.
 - 2. Backfilling site structures to subgrade elevations.
 - 3. Fill under slabs-on-grade.
 - 4. Fill under paving.
 - 5. Fill for over-excavation.
- B. Related Sections:
 - 1. Division 03- Concrete.
 - 2. Division 31- Earthwork.
 - 3. Division 33- Utilities.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Fill:
 - 1. Basis of Measurement: By cubic yard.
 - 2. Basis of Payment: Includes supplying fill materials, stockpiling, scarifying substrate surface, placing where required, and compacting.
- B. Structural Fill:
 - 1. Basis of Measurement: By cubic yard.
 - 2. Basis of Payment: Includes supplying fill material, stockpiling, scarifying substrate surface, placing where required, and compacting.
- C. Concrete Fill:
 - 1. Basis of Measurement: By cubic yard.
 - 2. Basis of Payment: Includes supplying fill material, forming, mixing and placing where required, and curing.

1.3 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
 - 1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³).
 - 2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.4 SUBMITTALS

- A. Division 01- General Requirements: Requirements for submittals.
- B. Product Data: Submit data for geotextile fabric indicating fabric and construction.
- C. Samples: Submit, in air-tight containers, 10 lb sample of each type of fill to testing laboratory.
- D. Materials Source: Submit name of imported fill materials suppliers.
- E. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 SUSTAINABLE DESIGN SUBMITTALS

- A. Division 01- General Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
 1. Materials Resources Certificates:
 - a. Certify source and origin for salvaged and reused products.
 - b. Certify recycled material content for recycled content products.
 - c. Certify source for regional materials and distance from Project site.
- C. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
 1. Provide cost data for the following products:
 - a. Salvaged, refurbished, and reused products.
 - b. Products with recycled material content.
 - c. Regional products.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with Standard Specifications for Public Works Construction (SSPWC) (Greenbook).

- B. Maintain one copy of each document on site.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Division 01- General Requirements: Requirements for sustainable design compliance.
- B. Materials and Resources Characteristics:
 - 1. Recycled Content Materials: Furnish materials with maximum available recycled content including.
 - a. Crushed Asphalt and/or Concrete.

2.2 FILL MATERIALS

- A. Subsoil Fill: as specified in SSPWC (Greenbook).
- B. Structural Fill: as specified in SSPWC (Greenbook).
- C. Granular Fill: as specified in SSPWC (Greenbook).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01- General Requirements: Coordination and project conditions.
- B. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- C. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.
- D. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 PREPARATION

- A. Compact subgrade to density requirements for subsequent backfill materials.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with structural fill and compact to density equal to or greater than requirements for subsequent fill material.

- C. Remove upper 12-inches of native soils be removed from areas to be graded. Actual depth shall be determined at the time of grading by the project geotechnical engineer/geologist.
- D. Following approval of the bottom, subexcavated areas should be scarified to minimum depth of 6-inches.
- E. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.3 BACKFILLING

- A. Backfill areas to contours and elevations with unfrozen materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- C. Place material in continuous layers as follows:
 - 1. Subsoil Fill: Maximum 8 inches compacted depth.
 - 2. Structural Fill: Maximum 6 inches compacted depth.
 - 3. Granular Fill: Maximum 6 inches compacted depth.
- D. Employ placement method that does not disturb or damage other work.
- E. Maintain optimum moisture content of backfill materials to attain required compaction density.
- F. Backfill against supported foundation walls. Do not backfill against unsupported foundation walls.
- G. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
- H. Slope grade away from building minimum 5 percent slope for minimum distance of 10 ft, unless noted otherwise.
- I. Make gradual grade changes. Blend slope into level areas.
- J. Remove surplus backfill materials from site.
- K. Leave fill material stockpile areas free of excess fill materials.

3.4 TOLERANCES

- A. Division 01- General Requirements: Tolerances.
- B. Top Surface of Backfilling Within Building Areas: Plus or minus 1 inch from required elevations.

- C. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.
- D. Top Surface of General Backfilling: Plus or minus 2 inches from required elevations.

3.5 FIELD QUALITY CONTROL

- A. Division 01- General Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Perform laboratory material tests in accordance with ASTM D1557.
- C. Perform in place compaction tests in accordance with the following:
 - 1. Density Tests: ASTM D1556.
 - 2. Moisture Tests: ASTM D3017.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.6 PROTECTION OF FINISHED WORK

- A. Division 01- General Requirements: Protecting finished work.
- B. Reshape and re-compact fills subjected to vehicular traffic.

END OF SECTION 312323

NOT FOR BID

SECTION 312513 - EROSION CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Diversion Channels.
 - 2. Rock Energy Dissipator.
 - 3. Paved Energy Dissipator.
 - 4. Rock Basin.
 - 5. Rock Barriers.
 - 6. Sediment Ponds.
 - 7. Sediment Traps.
- B. Related Requirements:
 - 1. Division 03- Concrete.
 - 2. Division 04- Masonry.
 - 3. Division 31- Earthwork.
 - 4. Division 32- Exterior Improvements.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Diversion Channel:
 - 1. Basis of Measurement: By linear foot.
 - 2. Basis of Payment: Includes excavating, windrowing, compacting, seeding, and mulching.
- B. Cleaning Sedimentation Structures:
 - 1. Basis of Measurement: By cubic yard.
 - 2. Basis of Payment: Includes removal, hauling and disposal of sediment and other debris in system.

1.3 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T88 - Standard Specification for Particle Size Analysis of Soils.
 - 2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. American Concrete Institute:
 - 1. ACI 301 - Specifications for Structural Concrete.
- C. ASTM International:
 - 1. ASTM C127 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.

2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³).
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³).
4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

D. Precast/Prestressed Concrete Institute:

1. PCI MNL-116S - Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.

1.4 SUBMITTALS

- A. Division 01- General Requirements: Requirements for submittals.
- B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 SUSTAINABLE DESIGN SUBMITTALS

- A. Division 01- General Requirements: Requirements for sustainable design submittals.
- B. Manufacturer's Certificate: Certify products meet or exceed specified sustainable design requirements.
 1. Materials Resources Certificates:
 - a. Certify recycled material content for recycled content products.
 - b. Certify source for regional materials and distance from Project site.

1.6 CLOSEOUT SUBMITTALS

- A. Division 01- General Requirements: Requirements for submittals.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with requirements of Division 31- Earthwork.
- B. Perform Work in accordance with Standard Specifications for Public Works Construction (SSPWC) (Greenbook).
- C. Maintain one copy of each document on site.

1.8 PRE-INSTALLATION MEETINGS

- A. Division 01- General Requirements: Pre-installation meeting.

- B. Convene minimum one week prior to commencing work of this section.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Division 01- General Requirements: Environmental conditions affecting products on site.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Division 01- General Requirements: Requirements for sustainable design compliance.

2.2 ROCK AND GEOTEXTILE MATERIALS

- A. Furnish materials in accordance with SSPWC (Greenbook).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01- General Requirements: Verification of existing conditions before starting work.
- B. Verify compacted subgrade and/or stabilized soil is acceptable and ready to support devices and imposed loads.
- C. Verify gradients and elevations of base or foundation for other work are correct.

3.2 SEDIMENT TRAPS

- A. Clear site, as specified in Division 31- Earthwork.
- B. Construct trap by excavating and forming embankments as specified in Division 31- Earthwork.
- C. Place coarse aggregate or rock at outlet as indicated on Drawings.
- D. Place geotextile fabric, as specified for rock energy dissipator.
- E. When required, obtain borrow excavation for formation of embankment, as specified in Division 31- Earthwork.
- F. On entire sediment trap area, apply soil supplements and sow seed as specified in Division 32- Exterior Improvements.