

07/16/2020

PROJECT MANUAL

Streets of West Pryor Lot 3 Multi-Tenant Building, Core & Shell Lee's Summit, MO

PROJECT NUMBER: 190224
DATE: March 2020



s c h w e r d t d e s i g n g r o u p i n c .
architecture interiors planning
2231 SW WANAMAKER ROAD SUITE 303 TOPEKA, KANSAS 66614 PHONE: 785-273-7540

07/16/2020

PROJECT MANUAL

March, 2020

PROJECT NUMBER: 190224

PROJECT

Streets of West Pryor, Lot 3
2050 NW Lowenstein Dr.
Lee's Summit, MO 64081

OWNER

Monarch Acquisitions, LLC
David N. Olson
P.O. Box 24302
Overland Park, KS 66283

ARCHITECT

Schwerdt Design Group
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mkh@sdgarch.com

CIVIL ENGINEER

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Columbia, MO 65203
785.241.9747
smcivilengr@gmail.com

STRUCTURAL ENGINEER

Certus Structural Engineers
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900 S Kansas Ave, Suite 400
Topeka, KS 66614
785.291.0400
aaron.scott@certusse.com

MECHANICAL/ELECTRICAL ENGINEER

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Topeka, KS 66614
785.273.2447
bryan.leinwetter@pkmreng.com

EXHIBIT "B" DRAWINGS AND REVISIONS TO DRAWINGS**APRIL 1, 2020**

DRAWING NUMBER	DRAWING TITLE	DATE	REVISION NUMBER/ISSUE
G-001	COVER SHEET	3/31/20	
G-002	UL DESIGNATIONS	3/31/20	
C1.0	COVER SHEET	3/25/20	
C1.1	PLAT	4/17/19	
C1.2	PLAT	4/17/19	
C2.0	SITE PLAN	3/25/20	
C2.1	SITE DETAILS	3/25/20	
C3.0	UTILITY PLAN	3/25/20	
C4.0	GRADING PLAN & STORM LINE A PLAN & PROFILE	3/25/20	
C4.1	ADA RAMP DETAILS	3/25/20	
C5.0	EROSION CONTROL PLAN	3/25/20	
C6.0	EROSION CONTROL DETAILS	3/25/20	
C7.0	DETAILS	3/25/20	
C8.0	DETAILS	3/25/20	
C9.0	DETAILS	3/25/20	
C10.0	LANDSCAPE PLAN	3/25/20	
A-100	SITE PLAN & TRASH ENCLOSURE DETAILS	3/31/20	
A-101	FIRST FLOOR PLAN	3/31/20	
A-102	ROOF PLAN	3/31/20	
A-201	BUILDING ELEVATIONS	3/31/20	
A-302	TENANT A WALL SECTIONS	3/31/20	
A-303	TENANT B WALL SECTIONS & DETAILS	3/31/20	
A-304	TENANT C WALL SECTIONS	3/31/20	
A-402	CANOPY & SCREEN WALL DETAILS	3/31/20	
A-601	DOOR SCHEDULE & DETAILS	3/31/20	
S-001	GENERAL NOTES	3/31/20	
S-101	FOUNDATION & WALL FRAMING PLANS	3/31/20	
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S-301	CONCRETE DETAILS & SECTIONS I	3/31/20	
S-601	FRAMING DETAILS & SECTIONS I	3/31/20	
S-602	FRAMING DETAILS & SECTIONS II	3/31/20	
ME-101	COVER SHEET	3/31/20	
ME-102	PHOTOMETRIC PLAN	3/31/20	
M-101	PLUMBING PLAN	3/31/20	
M-201	HVAC PLAN	3/31/20	
E-101	POWER PLAN	3/31/20	
E-201	LIGHTING PLAN	3/31/20	

**WEST PRYOR – LOT 3
LEE'S SUMMIT, MO – Project No. 190224**

**RELEASE FOR
CONSTRUCTION
AS NOTED ON PLANS REVIEW
DEVELOPMENT SERVICES
LEE'S SUMMIT, MISSOURI**

07/16/2020

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LEE’S SUMMIT, MO – Project No. 190224**

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DEVELOPMENT SERVICES
LEE’S SUMMIT, MISSOURI**

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DOCUMENT 000107 - SEALS PAGE
March 31, 2020

1.1 DESIGN PROFESSIONAL OF RECORD

A. Architect:

1. Mike Hampton
2. Missouri License #A2008027042
3. Responsible for Sections 01-49 except where indicated as prepared by other design professional of record.



DOCUMENT 000107 - SEALS PAGE
March 25, 2020

1.1 DESIGN PROFESSIONAL OF RECORD

B. Structural Engineer:

1. Kevin S. Vollrath
2. PE-2005011704
3. Responsible for:

033000 – Cast-In-Place Concrete
051200 – Structural Steel Framing
061000 – Rough Carpentry
061600 – Wood Sheathing
061753 – Shop-Fabricated Wood Trusses



DOCUMENT 000107 - SEALS PAGE
March 25, 2020

1.1 DESIGN PROFESSIONAL OF RECORD

C. Mechanical, Electrical & Plumbing Engineer:

1. Scott W. McKinley
2. PE-2016007380
3. Responsible for:
 - SECTION 220100 PLUMBING PROVISIONS
 - SECTION 220500 BASIC PLUMBING MATERIALS AND METHODS
 - SECTION 221000 - PIPING
 - SECTION 221500 - PIPING SPECIALTIES
 - SECTION 221800 - VALVES
 - SECTION 224000 - PLUMBING FIXTURES AND EQUIPMENT
 - SECTION 230100 HVAC PROVISIONS
 - SECTION 230500 BASIC HVAC MATERIALS AND METHODS
 - SECTION 233000 SHEET METAL
 - SECTION 236000 - HVAC AIR SIDE EQUIPMENT
 - SECTION 237000 - MECHANICAL SOUND AND VIBRATION CONTROL
 - SECTION 239900 SYSTEM TESTING & BALANCING
 - SECTION 260100 - ELECTRICAL PROVISIONS
 - SECTION 260500 BASIC ELECTRICAL MATERIALS AND METHODS
 - SECTION 262000 WIRING MEANS, METHODS, AND MATERIALS
 - SECTION 263000 WIRING DEVICES AND SPECIALTIES
 - SECTION 264000 - ELECTRICAL DISTRIBUTION
 - SECTION 265000 - ELECTRICAL EQUIPMENT
 - SECTION 266000 LUMINAIRES, LAMPS AND BALLASTS
 - SECTION 267100 - FIRE ALARM SYSTEM - ADDRESSABLE



MO State Certificate of
Authority #E-2002020886

07/16/2020

STRUCTURAL CALCULATIONS

Multi-Tenant Building – Parcel #3
Streets of West Pryor
Lee's Summit, Missouri

Certus Project #: 01190008.110

Prepared by:.....Aaron Scott, PE

Checked by:.....Kevin S. Vollrath, PE

Date:.....March 31, 2020

DESIGN CRITERIA

Project Location:

Lee's Summit, Missouri

Building Codes:

Code: 2018 International Building Code/
ASCE 7-16 Minimum Design Loads
for Buildings and Other Structures

Live Loads:

Roof = 20 psf

Snow Loads:

Ground Snow Load, $P_g = 25$ psf

Flat Roof Snow Load, $P_f = 20$ psf

Snow Exposure Factor, $C_e = 0.9$

Snow Load Importance Factor, $I_s = 1.0$

Thermal Factor, $C_t = 1.0$

Wind:

Basic Wind Speed, $V = 115$ mph

Wind Importance Factor, $I_w = 1.0$

Wind Exposure Category C

Non-Building Structure, $P_w = 20$ psf (min)

Seismic:

Seismic Importance Factor, $I_e = 1.0$

Occupancy Category II

Spectral Response Accelerations:

$S_S: 0.1274$

$S_1: 0.0612$

Spectral Response Coefficients

$S_{DS}: 0.102$

$S_{D1}: 0.069$

Site Class: D

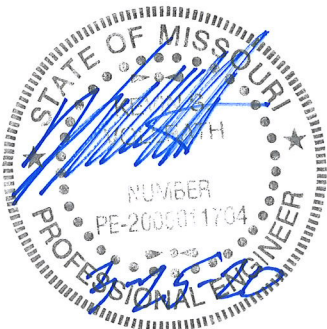
Seismic Design Category: B

Analysis Procedure: Equivalent Lateral Force

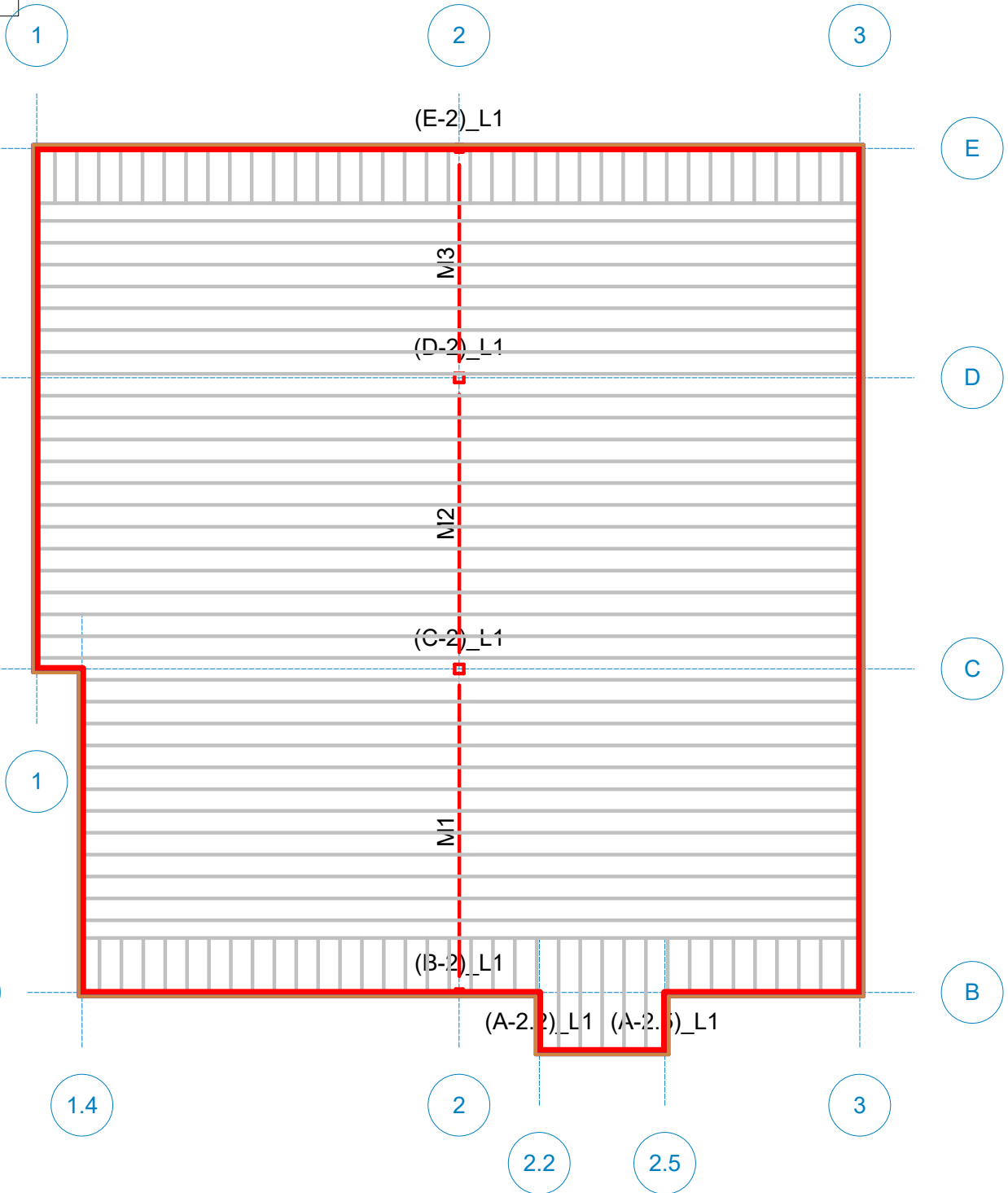
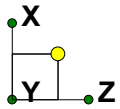
Foundations:

Max net allowable soil bearing pressure:

- 2500 psf for continuous footings
- 3000 psf for isolated spread footings



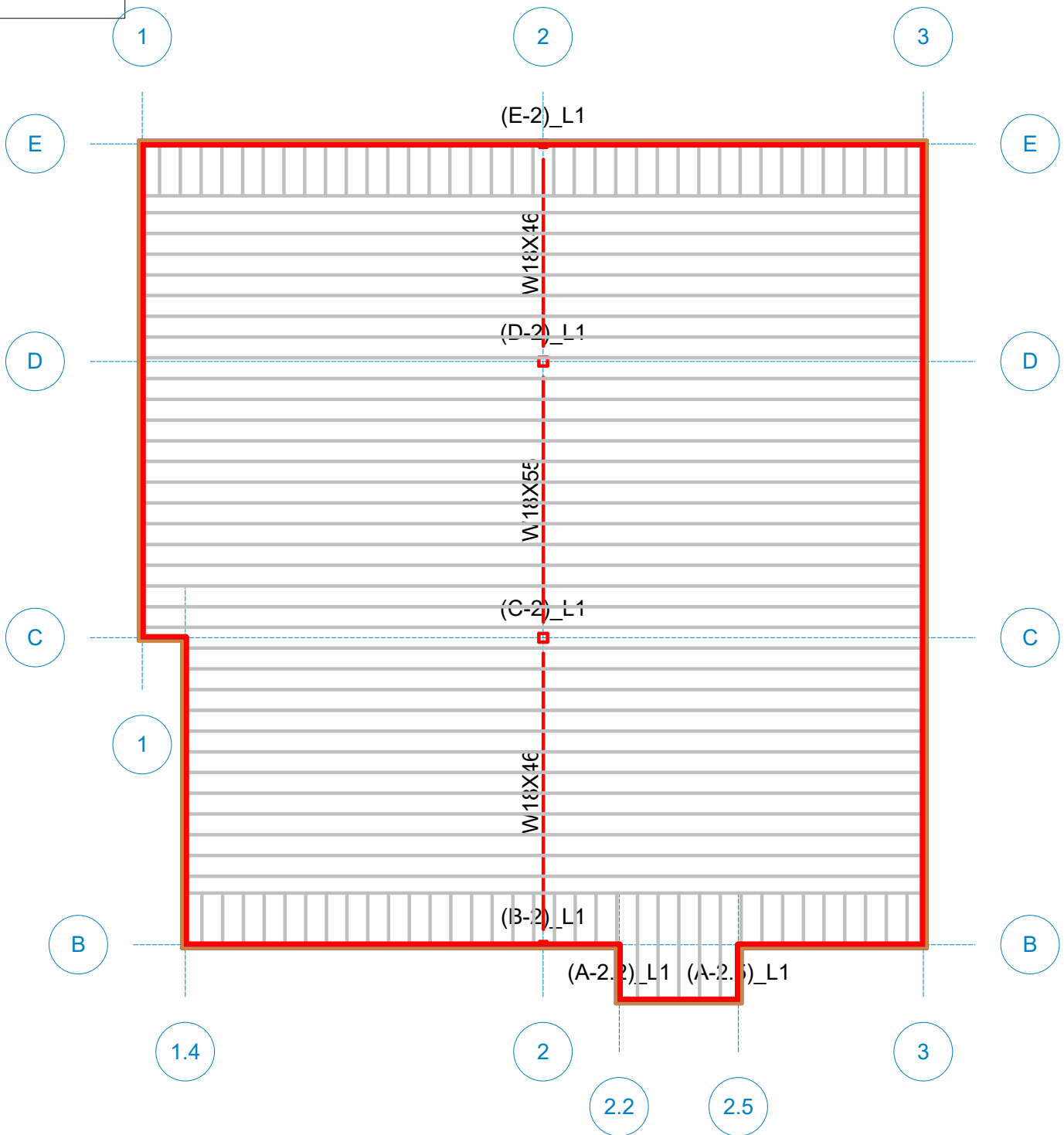
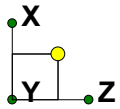
Lateral Gravity



Loads: DL PreComp - PreComposite Dead Load

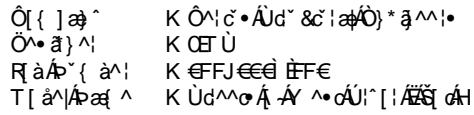
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Lateral Gravity



Member Camber
Loads: Envelop Results

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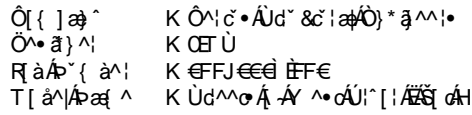
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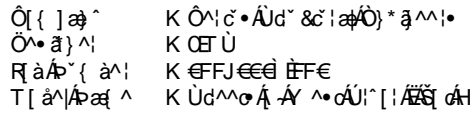
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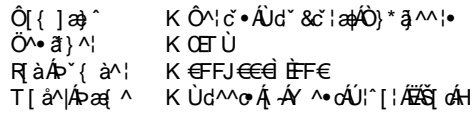
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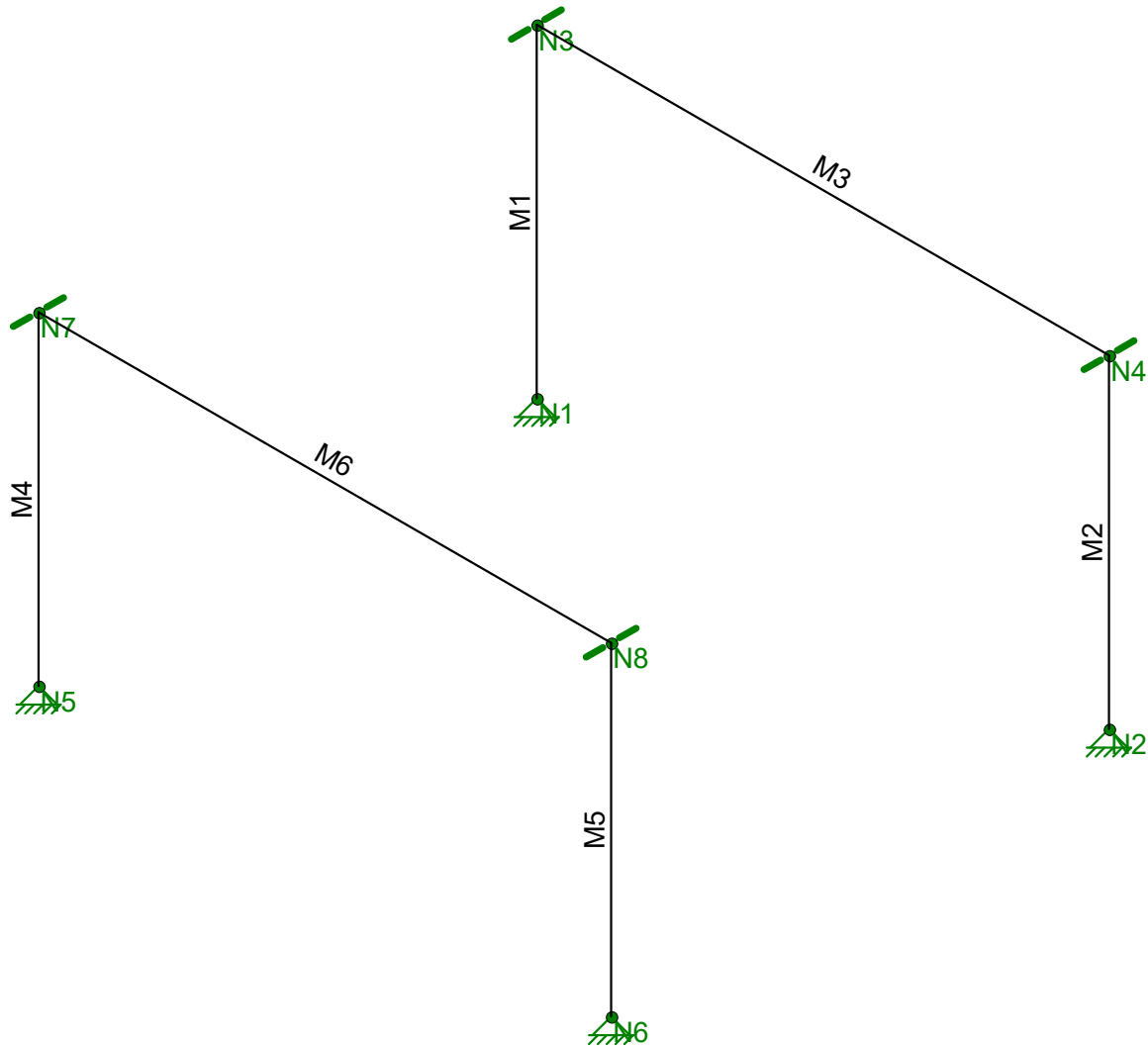
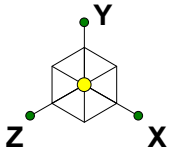
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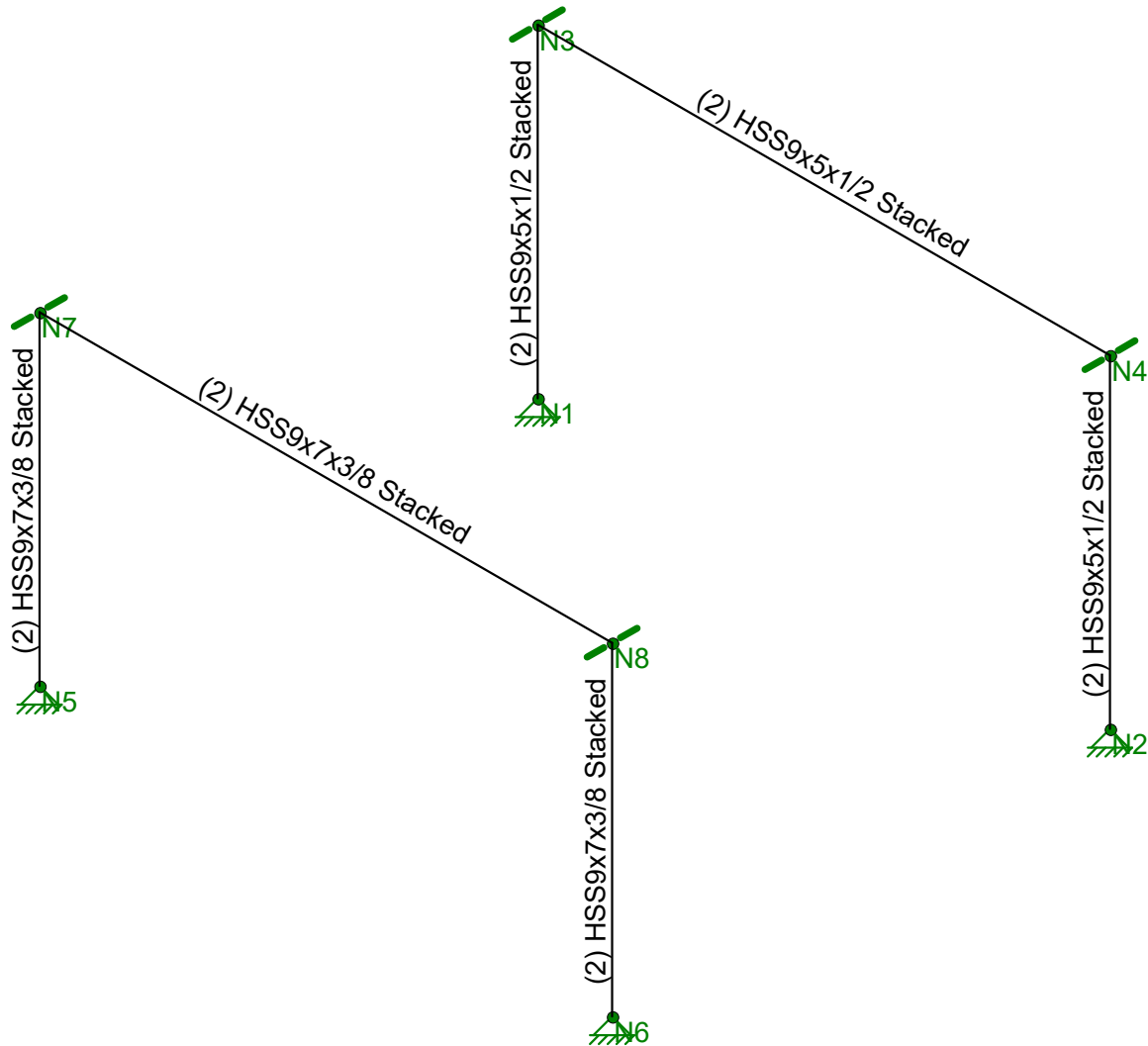
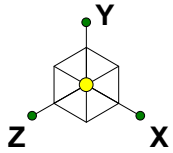
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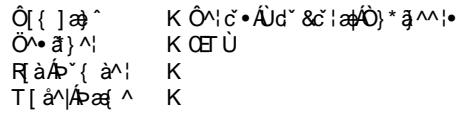
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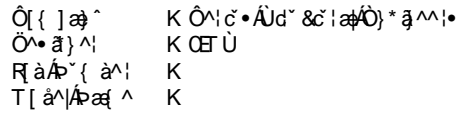
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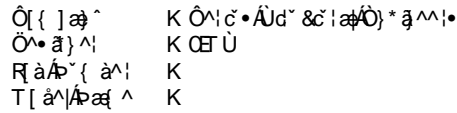


07/16/2020

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07/16/2020

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Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
+D+H													
Dsgn. L = 8.00 ft	1	0.601	0.059	2.88		2.88	8.01	4.79	1.14	1.00	1.44	40.50	24.25
+D+L+H													
Dsgn. L = 8.00 ft	1	0.601	0.059	2.88		2.88	8.01	4.79	1.14	1.00	1.44	40.50	24.25
+D+Lr+H													
Dsgn. L = 8.00 ft	1	0.601	0.059	2.88		2.88	8.01	4.79	1.14	1.00	1.44	40.50	24.25
+D+S+H													
Dsgn. L = 8.00 ft	1	0.601	0.059	2.88		2.88	8.01	4.79	1.14	1.00	1.44	40.50	24.25
+D+0.750Lr+0.750L+H													
Dsgn. L = 8.00 ft	1	0.601	0.059	2.88		2.88	8.01	4.79	1.14	1.00	1.44	40.50	24.25
+D+0.750L+0.750S+H													
Dsgn. L = 8.00 ft	1	0.601	0.059	2.88		2.88	8.01	4.79	1.14	1.00	1.44	40.50	24.25
+D+0.60W+H													
Dsgn. L = 8.00 ft	1	0.601	0.059	2.88		2.88	8.01	4.79	1.14	1.00	1.44	40.50	24.25
+D+0.750Lr+0.450W+H													
Dsgn. L = 8.00 ft	1	0.601	0.059	2.88		2.88	8.01	4.79	1.14	1.00	1.44	40.50	24.25
+D+0.750S+0.450W+H													
Dsgn. L = 8.00 ft	1	0.601	0.059	2.88		2.88	8.01	4.79	1.14	1.00	1.44	40.50	24.25
+0.60D+0.60W+0.60H													
Dsgn. L = 8.00 ft	1	0.360	0.036	1.73		1.73	8.01	4.79	1.14	1.00	0.86	40.50	24.25
+D+0.70E+0.60H													
Dsgn. L = 8.00 ft	1	0.601	0.059	2.88		2.88	8.01	4.79	1.14	1.00	1.44	40.50	24.25
+D+0.750L+0.750S+0.5250E+H													

Project Title: Streets of West Pryor - Lot 3
Engineer: Aaron M Scott
Project ID:
Project Descr:

**RELEASE FOR
CONSTRUCTION
AS NOTED ON PLANS REVIEW
DEVELOPMENT SERVICES
LEE'S SUMMIT, MISSOURI**

07/16/2020

Printed: 2 APR 2020, 10:44AM

Steel Beam

'ryor\01190008.110 - Streets of West Pryor - Lot 3\Calculations\01190008.110 - Streets of West Pryor - Lot 3.ec6 .

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Lic. # : KW-06007750

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Description : Loose Brick Lintel

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
Dsgn. L = 8.00 ft	1	0.601	0.059	2.88		2.88	8.01	4.79	1.14	1.00	1.44	40.50	24.25
+0.60D+0.70E+H													
Dsgn. L = 8.00 ft	1	0.360	0.036	1.73		1.73	8.01	4.79	1.14	1.00	0.86	40.50	24.25

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
D Only	1	0.1312	4.023		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.440	1.440
Overall MINimum	0.864	0.864
+D+H	1.440	1.440
+D+L+H	1.440	1.440
+D+Lr+H	1.440	1.440
+D+S+H	1.440	1.440
+D+0.750Lr+0.750L+H	1.440	1.440
+D+0.750L+0.750S+H	1.440	1.440
+D+0.60W+H	1.440	1.440
+D+0.750Lr+0.450W+H	1.440	1.440
+D+0.750S+0.450W+H	1.440	1.440
+0.60D+0.60W+0.60H	0.864	0.864
+D+0.70E+0.60H	1.440	1.440
+D+0.750L+0.750S+0.5250E+H	1.440	1.440
+0.60D+0.70E+H	0.864	0.864
D Only	1.440	1.440
Lr Only		
L Only		
S Only		
W Only		
E Only		
H Only		

Project Title: Streets of West Pryor - Lot 3
 Engineer: Aaron M Scott
 Project ID:
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LEE'S SUMMIT, MISSOURI

07/16/2020

Printed: 2 APR 2020, 10:44AM

Wood Beam

Lic. #: KW-06007750

Description: 11'-4" Headers

ryor\01190008.110 - Streets of West Pryor - Lot 3\Calculations\01190008.110 - Streets of West Pryor - Lot 3.ec6

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CODE REFERENCES

Calculations per

Load Combination Set: ASCE 7-16

Material Properties

Analysis Method: Allowable Stress Design

Load Combination: ASCE 7-16

Wood Species: Trus Joist

Wood Grade: Parallam PSL 2.0E

Beam Bracing: Beam is Fully Braced against lateral-torsional buckling

Fb + 2,900.0 psi

Fb - 2,900.0 psi

Fc - Prll 2,900.0 psi

Fc - Perp 625.0 psi

Fv 290.0 psi

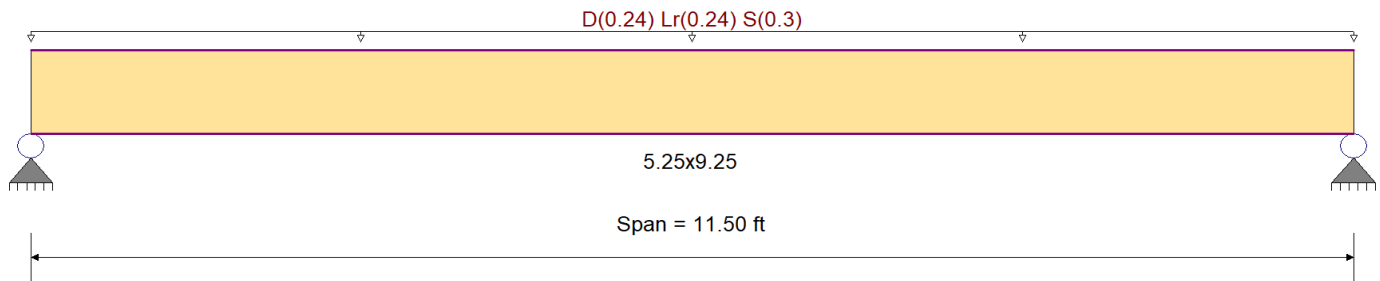
Ft 2,025.0 psi

E: Modulus of Elasticity

Ebend-xx 2,000.0 ksi

Eminbend-xx 1,016.54 ksi

Density 45.070 pcf



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Uniform Load: D = 0.020, Lr = 0.020, S = 0.0250 ksf, Tributary Width = 12.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.429 : 1	Maximum Shear Stress Ratio	=	0.250 : 1
Section used for this span		5.25x9.25	Section used for this span		5.25x9.25
fb : Actual	=	1,430.83 psi	fv : Actual	=	83.31 psi
FB : Allowable	=	3,335.00 psi	Fv : Allowable	=	333.50 psi
Load Combination		+D+S+H	Load Combination		+D+S+H
Location of maximum on span	=	5.750 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
Maximum Deflection					
Max Downward Transient Deflection		0.171 in	Ratio =		804 >= 360
Max Upward Transient Deflection		0.000 in	Ratio =		0 < 360
Max Downward Total Deflection		0.309 in	Ratio =		447 >= 240
Max Upward Total Deflection		0.000 in	Ratio =		0 < 240

Maximum Forces & Stresses for Load Combinations

Load Combination Segment Length	Span #	Max Stress Ratios						Moment Values						Shear Values		
		M	V	C _d	C _{F/V}	C _i	C _r	C _m	C _t	C _L	M	fb	F'b	V	fv	F'v
+D+H													0.00	0.00	0.00	0.00
Length = 11.50 ft	1	0.244	0.142	0.90	1.000	1.00	1.00	1.00	1.00	1.00	3.97	635.93	2610.00	1.20	37.03	261.00
+D+L+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1	0.219	0.128	1.00	1.000	1.00	1.00	1.00	1.00	1.00	3.97	635.93	2900.00	1.20	37.03	290.00
+D+Lr+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1	0.351	0.204	1.25	1.000	1.00	1.00	1.00	1.00	1.00	7.94	1,271.85	3625.00	2.40	74.05	362.50
+D+S+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1	0.429	0.250	1.15	1.000	1.00	1.00	1.00	1.00	1.00	8.93	1,430.83	3335.00	2.70	83.31	333.50
+D+0.750Lr+0.750L+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1	0.307	0.179	1.25	1.000	1.00	1.00	1.00	1.00	1.00	6.94	1,112.87	3625.00	2.10	64.79	362.50
+D+0.750L+0.750S+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00

Project Title: Streets of West Pryor - Lot 3
 Engineer: Aaron M Scott
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Wood Beam

ryor\01190008.110 - Streets of West Pryor - Lot 3\Calculations\01190008.110 - Streets of West Pryor - Lot 3.ec6 .

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Lic. # : KW-06007750

Licensee : CERTUS STRUCTURAL ENGINEERS

Description : 11'-4" Headers

Load Combination	Segment Length	Span #	Max Stress Ratios		C _d	C _{F/V}	C _i	C _r	C _m	C _t	C _L	Moment Values			Shear Values		
			M	V								M	fb	F'b	V	fv	F'v
Length = 11.50 ft	1		0.369	0.215	1.15	1.000	1.00	1.00	1.00	1.00	1.00	7.69	1,232.11	3335.00	2.32	71.74	333.50
+D+0.60W+H						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1		0.137	0.080	1.60	1.000	1.00	1.00	1.00	1.00	1.00	3.97	635.93	4640.00	1.20	37.03	464.00
+D+0.750Lr+0.450W+H						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1		0.240	0.140	1.60	1.000	1.00	1.00	1.00	1.00	1.00	6.94	1,112.87	4640.00	2.10	64.79	464.00
+D+0.750S+0.450W+H						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1		0.266	0.155	1.60	1.000	1.00	1.00	1.00	1.00	1.00	7.69	1,232.11	4640.00	2.32	71.74	464.00
+0.60D+0.60W+0.60H						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1		0.082	0.048	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.38	381.56	4640.00	0.72	22.22	464.00
+D+0.70E+0.60H						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1		0.137	0.080	1.60	1.000	1.00	1.00	1.00	1.00	1.00	3.97	635.93	4640.00	1.20	37.03	464.00
+D+0.750L+0.750S+0.5250E+H						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1		0.266	0.155	1.60	1.000	1.00	1.00	1.00	1.00	1.00	7.69	1,232.11	4640.00	2.32	71.74	464.00
+0.60D+0.70E+H						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1		0.082	0.048	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.38	381.56	4640.00	0.72	22.22	464.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	0.3086	5.792		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	3.105	3.105
Overall MINimum	1.725	1.725
+D+H	1.380	1.380
+D+L+H	1.380	1.380
+D+Lr+H	2.760	2.760
+D+S+H	3.105	3.105
+D+0.750Lr+0.750L+H	2.415	2.415
+D+0.750L+0.750S+H	2.674	2.674
+D+0.60W+H	1.380	1.380
+D+0.750Lr+0.450W+H	2.415	2.415
+D+0.750S+0.450W+H	2.674	2.674
+0.60D+0.60W+0.60H	0.828	0.828
+D+0.70E+0.60H	1.380	1.380
+D+0.750L+0.750S+0.5250E+H	2.674	2.674
+0.60D+0.70E+H	0.828	0.828
D Only	1.380	1.380
Lr Only	1.380	1.380
L Only		
S Only	1.725	1.725
W Only		
E Only		
H Only		

Project Title: Streets of West Pryor - Lot 3
 Engineer: Aaron M Scott
 Project ID:
 Project Descr:

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Wood Column

ryor\01190008.110 - Streets of West Pryor - Lot 3\Calculations\01190008.110 - Streets of West Pryor - Lot 3.ec6

Software copyright ENERCALC, INC. 1983-2018, Build:10.18.12.30

Lic. #: KW-06007750

Licensee: CERTUS STRUCTURAL ENGINEERS

Description: 15 ft tall 2x8 wall studs @ 16" OC

Code References

Calculations per NDS 2015, IBC 2018, CBC 2019, ASCE 7-10

Load Combinations Used: ASCE 7-16

General Information

Analysis Method : Allowable Stress Design				Wood Section Name 2x8	
End Fixities Top & Bottom Pinned				Wood Grading/Manuf. Graded Lumber	
Overall Column Height		15.0 ft		Wood Member Type Sawn	
(Used for non-slender calculations)					
Wood Species Douglas Fir - Larch		Exact Width 1.50 in Allow Stress Modification Factors			
Wood Grade No.2		Exact Depth 7.250 in Cf or Cv for Bending 1.20			
Fb +	900.0 psi	Fv	180.0 psi	Area	10.875 in^2 Cf or Cv for Compression 1.050
Fb -	900.0 psi	Ft	575.0 psi	Ix	47.635 in^4 Cf or Cv for Tension 1.20
Fc - Prll	1,350.0 psi	Density	31.210 pcf	Iy	2.039 in^4 Cm : Wet Use Factor 1.0
Fc - Perp	625.0 psi				Ct : Temperature Factor 1.0
E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial		Cfu : Flat Use Factor 1.0
	Basic	1,600.0	1,600.0	1,600.0 ksi	Kf : Built-up columns 1.0 NDS 15.3.2
	Minimum	580.0	580.0		Use Cr : Repetitive ? No
Brace condition for deflection (buckling) along columns :					
				X-X (width) axis :	Fully braced against buckling ABOUT Y-Y Axis
				Y-Y (depth) axis :	Lu for buckling ABOUT X-X Axis: K = 1.0

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 35.355 lbs * Dead Load Factor

AXIAL LOADS . . .

Roof: Axial Load at 15.0 ft, D = 0.2940, Lr = 0.2940, S = 0.3670 k

BENDING LOADS . . .

Lat. Uniform Load creating Mx-x, W = 0.0270 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS	Max. Axial+Bending Stress Ratio =	0.2524 : 1	Maximum SERVICE Lateral Load Reactions . .			
	Load Combination	+D+0.60W	Top along Y-Y	0.0 k	Bottom along Y-Y	0.0 k
	Governing NDS Formula	Comp + Mxx, NDS Eq. 3.9-3	Top along X-X	0.0 k	Bottom along X-X	0.0 k
	Location of max.above base	7.450 ft	Maximum SERVICE Load Lateral Deflections . . .			
	At maximum location values are . . .		Along Y-Y	0.0 in	at	7.550 ft above base
	Applied Axial	0.3294 k	for load combination : W Only			
	Applied Mx	0.4556 k-ft	Along X-X	0.0 in	at	0.0 ft above base
	Applied My	0.0 k-ft	for load combination : n/a			
	Fc : Allowable	708.97 psi	Other Factors used to calculate allowable stresses . . .			
			<u>Bending</u>		<u>Compression</u>	<u>Tension</u>
PASS	Maximum Shear Stress Ratio =	0.05819 : 1				
	Load Combination	+D+0.60W				
	Location of max.above base	0.0 ft				
	Applied Design Shear	16.759 psi				
	Allowable Shear	288.0 psi				

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
D Only	0.900	0.504	0.04711	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+Lr	1.250	0.387	0.08349	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+S	1.150	0.415	0.09456	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+0.750Lr	1.250	0.387	0.07364	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+0.750S	1.150	0.415	0.08210	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+0.60W	1.600	0.313	0.2524	PASS	7.450 ft	0.05819	PASS	0.0 ft
+D-0.60W	1.600	0.313	0.2524	PASS	7.450 ft	0.05819	PASS	0.0 ft
+D+0.750Lr+0.450W	1.600	0.313	0.1983	PASS	7.550 ft	0.04364	PASS	0.0 ft
+D+0.750Lr-0.450W	1.600	0.313	0.1983	PASS	7.550 ft	0.04364	PASS	0.0 ft

Project Title: Streets of West Pryor - Lot 3
 Engineer: Aaron M Scott
 Project ID:
 Project Descr:

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Wood Column

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Lic. # : KW-06007750

Licensee : CERTUS STRUCTURAL ENGINEERS

Description : 15 ft tall 2x8 wall studs @ 16" OC

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
+D+0.750S+0.450W	1.600	0.313	0.2007	PASS	7.550 ft	0.04364	PASS	0.0 ft
+D+0.750S-0.450W	1.600	0.313	0.2007	PASS	7.550 ft	0.04364	PASS	0.0 ft
+0.60D+0.60W	1.600	0.313	0.2472	PASS	7.450 ft	0.05819	PASS	0.0 ft
+0.60D-0.60W	1.600	0.313	0.2472	PASS	7.450 ft	0.05819	PASS	0.0 ft
+0.60D	1.600	0.313	0.02563	PASS	0.0 ft	0.0	PASS	15.0 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		k	Y-Y Axis Reaction		Axial Reaction	My - End Moments		k-ft	Mx - End Moments	
	@ Base	@ Top		@ Base	@ Top	@ Base	@ Base	@ Top		@ Base	@ Top
D Only						0.329					
+D+Lr						0.623					
+D+S						0.696					
+D+0.750Lr						0.550					
+D+0.750S						0.605					
+D+0.60W				0.122	0.121	0.329					
+D+0.750Lr+0.450W				0.091	0.091	0.550					
+D+0.750S+0.450W				0.091	0.091	0.605					
+0.60D+0.60W				0.122	0.121	0.198					
+0.60D						0.198					
Lr Only						0.294					
S Only						0.367					
W Only				0.203	0.202						

Maximum Deflections for Load Combinations

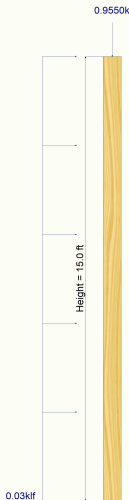
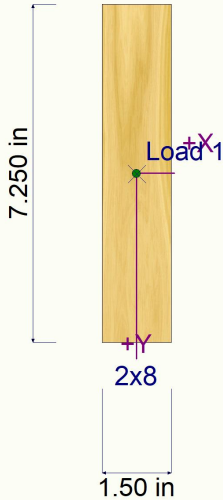
Load Combination	Max. X-X Deflection		Distance	Max. Y-Y Deflection		Distance
D Only	0.0000	in	0.000 ft	0.000	in	0.000 ft
+D+Lr	0.0000	in	0.000 ft	0.000	in	0.000 ft
+D+S	0.0000	in	0.000 ft	0.000	in	0.000 ft
+D+0.750Lr	0.0000	in	0.000 ft	0.000	in	0.000 ft
+D+0.750S	0.0000	in	0.000 ft	0.000	in	0.000 ft
+D+0.60W	0.0000	in	0.000 ft	0.245	in	7.550 ft
+D+0.750Lr+0.450W	0.0000	in	0.000 ft	0.184	in	7.550 ft
+D+0.750S+0.450W	0.0000	in	0.000 ft	0.184	in	7.550 ft
+0.60D+0.60W	0.0000	in	0.000 ft	0.245	in	7.550 ft
+0.60D	0.0000	in	0.000 ft	0.000	in	0.000 ft
Lr Only	0.0000	in	0.000 ft	0.000	in	0.000 ft
S Only	0.0000	in	0.000 ft	0.000	in	0.000 ft
W Only	0.0000	in	0.000 ft	0.408	in	7.550 ft

Wood Column

Lic. # : KW-06007750
Description : 15 ft tall 2x8 wall studs @ 16" OC

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Sketches



Project Title: Streets of West Pryor - Lot 3
 Engineer: Aaron M Scott
 Project ID:
 Project Descr:

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Wood Column

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Licensee: CERTUS STRUCTURAL ENGINEERS

Description: 15 ft tall 2x6 wall studs @ 16" OC (Deflection does not work for 2x6 studs)

Code References

Calculations per NDS 2015, IBC 2018, CBC 2019, ASCE 7-10

Load Combinations Used: ASCE 7-16

General Information

Analysis Method : Allowable Stress Design				Wood Section Name 2x6	
End Fixities Top & Bottom Pinned				Wood Grading/Manuf. Graded Lumber	
Overall Column Height		15.0 ft		Wood Member Type Sawn	
(Used for non-slender calculations)					
Wood Species Hem Fir				Exact Width 1.50 in	
Wood Grade No.2				Exact Depth 5.50 in	
Fb + 850.0 psi		Fv 150.0 psi		Area 8.250 in^2	
Fb - 850.0 psi		Ft 525.0 psi		Ix 20.797 in^4	
Fc - Prll 1,300.0 psi		Density 26.840 pcf		Iy 1.547 in^4	
Fc - Perp 405.0 psi					
E : Modulus of Elasticity . . .		x-x Bending y-y Bending		Axial	
Basic 1,300.0		1,300.0		1,300.0 ksi	
Minimum 470.0		470.0			
Allow Stress Modification Factors					
Cf or Cv for Bending 1.30					
Cf or Cv for Compression 1.10					
Cf or Cv for Tension 1.30					
Cm : Wet Use Factor 1.0					
Ct : Temperature Factor 1.0					
Cfu : Flat Use Factor 1.0					
Kf : Built-up columns 1.0					
Use Cr : Repetitive ? No					
NDS 15.3.2					
Brace condition for deflection (buckling) along columns :					
X-X (width) axis : Fully braced against buckling ABOUT Y-Y Axis					
Y-Y (depth) axis : Lu for buckling ABOUT X-X Axis: K = 1.0					

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 23.066 lbs * Dead Load Factor

AXIAL LOADS . . .

Roof: Axial Load at 15.0 ft, D = 0.2940, Lr = 0.2940, S = 0.3670 k

BENDING LOADS . . .

Lat. Uniform Load creating Mx-x, W = 0.0270 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS	Max. Axial+Bending Stress Ratio =	0.4699 : 1	Maximum SERVICE Lateral Load Reactions . .			
	Load Combination	+D+0.60W	Top along Y-Y	0.0 k	Bottom along Y-Y	0.0 k
	Governing NDS Formula	Comp + Mxx, NDS Eq. 3.9-3	Top along X-X	0.0 k	Bottom along X-X	0.0 k
	Location of max.above base	7.450 ft	Maximum SERVICE Load Lateral Deflections . . .			
	At maximum location values are . . .		Along Y-Y	0.0 in	at	7.550 ft above base
	Applied Axial	0.3171 k	for load combination : W Only			
	Applied Mx	0.4556 k-ft	Along X-X	0.0 in	at	0.0 ft above base
	Applied My	0.0 k-ft	for load combination : n/a			
	Fc : Allowable	348.202 psi	Other Factors used to calculate allowable stresses . . .			
			<u>Bending</u> <u>Compression</u> <u>Tension</u>			
PASS	Maximum Shear Stress Ratio =	0.09205 : 1				
	Load Combination	+D+0.60W				
	Location of max.above base	0.0 ft				
	Applied Design Shear	22.091 psi				
	Allowable Shear	240.0 psi				

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
D Only	0.900	0.262	0.1141	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+Lr	1.250	0.193	0.2151	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+S	1.150	0.208	0.2420	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+0.750Lr	1.250	0.193	0.1893	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+0.750S	1.150	0.208	0.2095	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+0.60W	1.600	0.152	0.4699	PASS	7.450 ft	0.09205	PASS	0.0 ft
+D-0.60W	1.600	0.152	0.4699	PASS	7.450 ft	0.09205	PASS	0.0 ft
+D+0.750Lr+0.450W	1.600	0.152	0.4093	PASS	7.550 ft	0.06903	PASS	0.0 ft
+D+0.750Lr-0.450W	1.600	0.152	0.4093	PASS	7.550 ft	0.06903	PASS	0.0 ft

Project Title: Streets of West Pryor - Lot 3
 Engineer: Aaron M Scott
 Project ID:
 Project Descr:

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Lic. # : KW-06007750

Licensee : CERTUS STRUCTURAL ENGINEERS

Description : 15 ft tall 2x6 wall studs @ 16" OC (Deflection does not work for 2x6 studs)

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
+D+0.750S+0.450W	1.600	0.152	0.4254	PASS	7.550 ft	0.06903	PASS	0.0 ft
+D+0.750S-0.450W	1.600	0.152	0.4254	PASS	7.550 ft	0.06903	PASS	0.0 ft
+0.60D+0.60W	1.600	0.152	0.4412	PASS	7.450 ft	0.09205	PASS	0.0 ft
+0.60D-0.60W	1.600	0.152	0.4412	PASS	7.450 ft	0.09205	PASS	0.0 ft
+0.60D	1.600	0.152	0.06622	PASS	0.0 ft	0.0	PASS	15.0 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		k	Y-Y Axis Reaction		Axial Reaction	My - End Moments		k-ft	Mx - End Moments	
	@ Base	@ Top		@ Base	@ Top	@ Base	@ Base	@ Top		@ Base	@ Top
D Only						0.317					
+D+Lr						0.611					
+D+S						0.684					
+D+0.750Lr						0.538					
+D+0.750S						0.592					
+D+0.60W				0.122	0.121	0.317					
+D+0.750Lr+0.450W				0.091	0.091	0.538					
+D+0.750S+0.450W				0.091	0.091	0.592					
+0.60D+0.60W				0.122	0.121	0.190					
+0.60D						0.190					
Lr Only						0.294					
S Only						0.367					
W Only				0.203	0.202						

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Distance	Max. Y-Y Deflection		Distance
D Only	0.0000	in	0.000 ft	0.000	in	0.000 ft
+D+Lr	0.0000	in	0.000 ft	0.000	in	0.000 ft
+D+S	0.0000	in	0.000 ft	0.000	in	0.000 ft
+D+0.750Lr	0.0000	in	0.000 ft	0.000	in	0.000 ft
+D+0.750S	0.0000	in	0.000 ft	0.000	in	0.000 ft
+D+0.60W	0.0000	in	0.000 ft	0.690	in	7.550 ft
+D+0.750Lr+0.450W	0.0000	in	0.000 ft	0.517	in	7.550 ft
+D+0.750S+0.450W	0.0000	in	0.000 ft	0.517	in	7.550 ft
+0.60D+0.60W	0.0000	in	0.000 ft	0.690	in	7.550 ft
+0.60D	0.0000	in	0.000 ft	0.000	in	0.000 ft
Lr Only	0.0000	in	0.000 ft	0.000	in	0.000 ft
S Only	0.0000	in	0.000 ft	0.000	in	0.000 ft
W Only	0.0000	in	0.000 ft	1.150	in	7.550 ft

Project Title: Streets of West Pryor - Lot 3
Engineer: Aaron M Scott
Project ID:
Project Descr:

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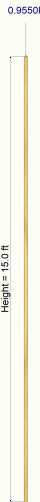
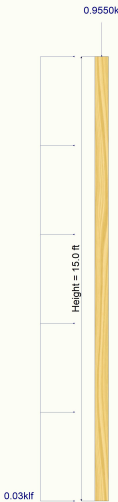
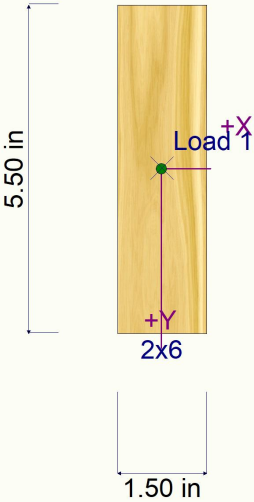
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Description : 15 ft tall 2x6 wall studs @ 16" OC (Deflection does not work for 2x6 studs)

Sketches



Project Title: Streets of West Pryor - Lot 3
 Engineer: Aaron M Scott
 Project ID:
 Project Descr:

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Description: 15 ft tall 2x6 wall studs @ 12" OC (Deflection does not work for 2x6 studs)

Code References

Calculations per NDS 2015, IBC 2018, CBC 2019, ASCE 7-10

Load Combinations Used: ASCE 7-16

General Information

Analysis Method : Allowable Stress Design				Wood Section Name 2x6	
End Fixities Top & Bottom Pinned				Wood Grading/Manuf. Graded Lumber	
Overall Column Height		15.0 ft		Wood Member Type Sawn	
(Used for non-slender calculations)					
Wood Species Douglas Fir - Larch		Exact Width 1.50 in Allow Stress Modification Factors			
Wood Grade No.2		Exact Depth 5.50 in Cf or Cv for Bending 1.30			
Fb +	900.0 psi	Fv	180.0 psi	Area	8.250 in^2 Cf or Cv for Compression 1.10
Fb -	900.0 psi	Ft	575.0 psi	Ix	20.797 in^4 Cf or Cv for Tension 1.30
Fc - Prll	1,350.0 psi	Density	31.210 pcf	Iy	1.547 in^4 Cm : Wet Use Factor 1.0
Fc - Perp	625.0 psi				Ct : Temperature Factor 1.0
E : Modulus of Elasticity . . .		x-x Bending	y-y Bending	Axial	Cfu : Flat Use Factor 1.0
	Basic	1,600.0	1,600.0	1,600.0 ksi	Kf : Built-up columns 1.0 NDS 15.3.2
	Minimum	580.0	580.0		Use Cr : Repetitive ? No
Brace condition for deflection (buckling) along columns :					
				X-X (width) axis :	Fully braced against buckling ABOUT Y-Y Axis
				Y-Y (depth) axis :	Lu for buckling ABOUT X-X Axis: K = 1.0

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 26.821 lbs * Dead Load Factor

AXIAL LOADS . . .

Roof: Axial Load at 15.0 ft, D = 0.220, Lr = 0.220, S = 0.2750 k

BENDING LOADS . . .

Lat. Uniform Load creating Mx-x, W = 0.020 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio =	0.3116 : 1	Maximum SERVICE Lateral Load Reactions . .	
Load Combination	+D+0.60W	Top along Y-Y	0.0 k
Governing NDS Formula	Comp + Mxx, NDS Eq. 3.9-3	Bottom along Y-Y	0.0 k
Location of max.above base	7.450 ft	Top along X-X	0.0 k
At maximum location values are . . .		Bottom along X-X	0.0 k
Applied Axial	0.2468 k	Maximum SERVICE Load Lateral Deflections . . .	
Applied Mx	0.3375 k-ft	Along Y-Y	0.0 in at 7.550 ft above base
Applied My	0.0 k-ft	for load combination : W Only	
Fc : Allowable	426.465 psi	Along X-X	0.0 in at 0.0 ft above base
		for load combination : n/a	
PASS Maximum Shear Stress Ratio =	0.05682 : 1	Other Factors used to calculate allowable stresses . . .	
Load Combination	+D+0.60W	Bending	Compression
Location of max.above base	0.0 ft		Tension
Applied Design Shear	16.364 psi		
Allowable Shear	288.0 psi		

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
D Only	0.900	0.306	0.07314	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+Lr	1.250	0.227	0.1346	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+S	1.150	0.245	0.1513	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+0.750Lr	1.250	0.227	0.1187	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+0.750S	1.150	0.245	0.1314	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+0.60W	1.600	0.179	0.3116	PASS	7.450 ft	0.05682	PASS	0.0 ft
+D-0.60W	1.600	0.179	0.3116	PASS	7.450 ft	0.05682	PASS	0.0 ft
+D+0.750Lr+0.450W	1.600	0.179	0.2553	PASS	7.450 ft	0.04261	PASS	0.0 ft
+D+0.750Lr-0.450W	1.600	0.179	0.2553	PASS	7.450 ft	0.04261	PASS	0.0 ft

Project Title: Streets of West Pryor - Lot 3
 Engineer: Aaron M Scott
 Project ID:
 Project Descr:

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Description : 15 ft tall 2x6 wall studs @ 12" OC (Deflection does not work for 2x6 studs)

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
+D+0.750S+0.450W	1.600	0.179	0.2613	PASS	7.450 ft	0.04261	PASS	0.0 ft
+D+0.750S-0.450W	1.600	0.179	0.2613	PASS	7.450 ft	0.04261	PASS	0.0 ft
+0.60D+0.60W	1.600	0.179	0.2999	PASS	7.450 ft	0.05682	PASS	0.0 ft
+0.60D-0.60W	1.600	0.179	0.2999	PASS	7.450 ft	0.05682	PASS	0.0 ft
+0.60D	1.600	0.179	0.04209	PASS	0.0 ft	0.0	PASS	15.0 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		k	Y-Y Axis Reaction		Axial Reaction	My - End Moments		Mx - End Moments
	@ Base	@ Top		@ Base	@ Top		@ Base	@ Top	
D Only						0.247			
+D+Lr						0.467			
+D+S						0.522			
+D+0.750Lr						0.412			
+D+0.750S						0.453			
+D+0.60W				0.090	0.090	0.247			
+D+0.750Lr+0.450W				0.068	0.067	0.412			
+D+0.750S+0.450W				0.068	0.067	0.453			
+0.60D+0.60W				0.090	0.090	0.148			
+0.60D						0.148			
Lr Only						0.220			
S Only						0.275			
W Only				0.150	0.150				

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Distance	Max. Y-Y Deflection		Distance
D Only	0.0000	in	0.000 ft	0.000	in	0.000 ft
+D+Lr	0.0000	in	0.000 ft	0.000	in	0.000 ft
+D+S	0.0000	in	0.000 ft	0.000	in	0.000 ft
+D+0.750Lr	0.0000	in	0.000 ft	0.000	in	0.000 ft
+D+0.750S	0.0000	in	0.000 ft	0.000	in	0.000 ft
+D+0.60W	0.0000	in	0.000 ft	0.415	in	7.550 ft
+D+0.750Lr+0.450W	0.0000	in	0.000 ft	0.311	in	7.550 ft
+D+0.750S+0.450W	0.0000	in	0.000 ft	0.311	in	7.550 ft
+0.60D+0.60W	0.0000	in	0.000 ft	0.415	in	7.550 ft
+0.60D	0.0000	in	0.000 ft	0.000	in	0.000 ft
Lr Only	0.0000	in	0.000 ft	0.000	in	0.000 ft
S Only	0.0000	in	0.000 ft	0.000	in	0.000 ft
W Only	0.0000	in	0.000 ft	0.692	in	7.550 ft

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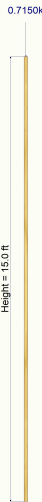
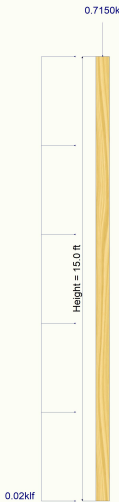
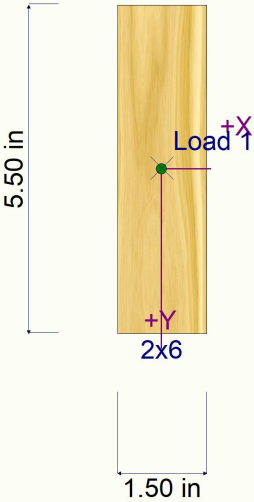
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Description : 15 ft tall 2x6 wall studs @ 12" OC (Deflection does not work for 2x6 studs)

Sketches



Project Title: Streets of West Pryor - Lot 3
 Engineer: Aaron M Scott
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Description : 15 ft tall Engineered 2x6 wall studs @ 12" OC

Code References

Calculations per NDS 2015, IBC 2018, CBC 2019, ASCE 7-10

Load Combinations Used : ASCE 7-16

General Information

Analysis Method : Allowable Stress Design				Wood Section Name 3.5x5.5	
End Fixities Top & Bottom Pinned				Wood Grading/Manuf. Trus Joist	
Overall Column Height		15.0 ft		Wood Member Type TimberStrand LSL	
(Used for non-slender calculations)					
Wood Species Trus Joist		Exact Width 3.50 in Allow Stress Modification Factors			
Wood Grade TimberStrand LSL 1.3E - Bear		Exact Depth 5.50 in Cf or Cv for Bending 1.0			
Fb +	1,700.0 psi	Fv	425.0 psi	Area	19.250 in^2 Cf or Cv for Compression 1.0
Fb -	1,700.0 psi	Ft	1,075.0 psi	Ix	48.526 in^4 Cf or Cv for Tension 1.0
Fc - Prll	1,835.0 psi	Density	45.010 pcf	Iy	19.651 in^4 Cm : Wet Use Factor 1.0
Fc - Perp	710.0 psi				Ct : Temperature Factor 1.0
E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial		Cfu : Flat Use Factor 1.0
	Basic	1,300.0	1,300.0	1,300.0 ksi	Kf : Built-up columns 1.0 NDS 15.3.2
	Minimum	660.75	660.75		Use Cr : Repetitive ? No
Brace condition for deflection (buckling) along columns :					
				X-X (width) axis :	Fully braced against buckling ABOUT Y-Y Axis
				Y-Y (depth) axis :	Lu for buckling ABOUT X-X Axis: K = 1.0

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 90.254 lbs * Dead Load Factor

AXIAL LOADS . . .

Roof: Axial Load at 15.0 ft, D = 0.220, Lr = 0.220, S = 0.2750 k

BENDING LOADS . . .

Lat. Uniform Load creating Mx-x, W = 0.0180 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS	Max. Axial+Bending Stress Ratio =	0.07948 : 1	Maximum SERVICE Lateral Load Reactions . .			
	Load Combination	+D+0.60W	Top along Y-Y	0.0 k	Bottom along Y-Y	0.0 k
	Governing NDS Formula	Comp + Mxx, NDS Eq. 3.9-3	Top along X-X	0.0 k	Bottom along X-X	0.0 k
	Location of max.above base	7.450 ft	Maximum SERVICE Load Lateral Deflections . . .			
	At maximum location values are . . .		Along Y-Y	0.0 in	at	7.550 ft above base
	Applied Axial	0.3103 k	for load combination : W Only			
	Applied Mx	0.3037 k-ft	Along X-X	0.0 in	at	0.0 ft above base
	Applied My	0.0 k-ft	for load combination : n/a			
	Fc : Allowable	496.969 psi	Other Factors used to calculate allowable stresses . . .			
			<u>Bending</u>		<u>Compression</u>	<u>Tension</u>
PASS	Maximum Shear Stress Ratio =	0.009282 : 1				
	Load Combination	+D+0.60W				
	Location of max.above base	0.0 ft				
	Applied Design Shear	6.312 psi				
	Allowable Shear	680.0 psi				

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
D Only	0.900	0.295	0.03311	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+Lr	1.250	0.215	0.05581	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+S	1.150	0.233	0.06178	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+0.750Lr	1.250	0.215	0.05002	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+0.750S	1.150	0.233	0.05452	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+0.60W	1.600	0.169	0.07948	PASS	7.450 ft	0.009282	PASS	0.0 ft
+D-0.60W	1.600	0.169	0.07948	PASS	7.450 ft	0.009282	PASS	0.0 ft
+D+0.750Lr+0.450W	1.600	0.169	0.06234	PASS	7.450 ft	0.006961	PASS	0.0 ft
+D+0.750Lr-0.450W	1.600	0.169	0.06234	PASS	7.450 ft	0.006961	PASS	0.0 ft

Project Title: Streets of West Pryor - Lot 3
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Description : 15 ft tall Engineered 2x6 wall studs @ 12" OC

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
+D+0.750S+0.450W	1.600	0.169	0.06305	PASS	7.450 ft	0.006961	PASS	0.0 ft
+D+0.750S-0.450W	1.600	0.169	0.06305	PASS	7.450 ft	0.006961	PASS	0.0 ft
+0.60D+0.60W	1.600	0.169	0.07779	PASS	7.450 ft	0.009282	PASS	0.0 ft
+0.60D-0.60W	1.600	0.169	0.07779	PASS	7.450 ft	0.009282	PASS	0.0 ft
+0.60D	1.600	0.169	0.01946	PASS	0.0 ft	0.0	PASS	15.0 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		k	Y-Y Axis Reaction		Axial Reaction	My - End Moments		Mx - End Moments
	@ Base	@ Top		@ Base	@ Top		@ Base	@ Top	
D Only						0.310			
+D+Lr						0.530			
+D+S						0.585			
+D+0.750Lr						0.475			
+D+0.750S						0.517			
+D+0.60W				0.081	0.081	0.310			
+D+0.750Lr+0.450W				0.061	0.061	0.475			
+D+0.750S+0.450W				0.061	0.061	0.517			
+0.60D+0.60W				0.081	0.081	0.186			
+0.60D						0.186			
Lr Only						0.220			
S Only						0.275			
W Only				0.135	0.135				

Maximum Deflections for Load Combinations

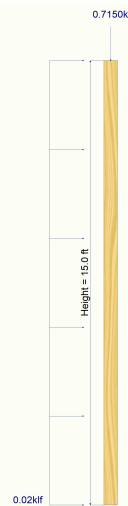
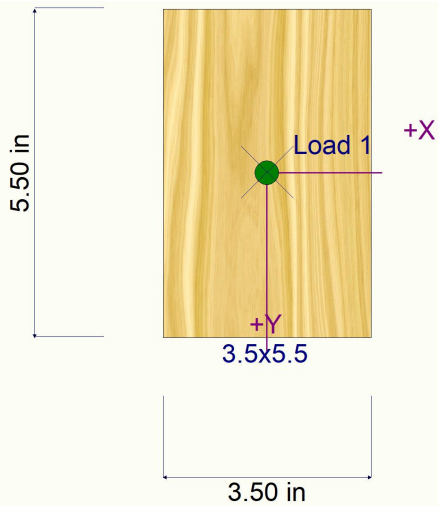
Load Combination	Max. X-X Deflection		Distance	Max. Y-Y Deflection		Distance
D Only	0.0000	in	0.000 ft	0.000	in	0.000 ft
+D+Lr	0.0000	in	0.000 ft	0.000	in	0.000 ft
+D+S	0.0000	in	0.000 ft	0.000	in	0.000 ft
+D+0.750Lr	0.0000	in	0.000 ft	0.000	in	0.000 ft
+D+0.750S	0.0000	in	0.000 ft	0.000	in	0.000 ft
+D+0.60W	0.0000	in	0.000 ft	0.197	in	7.550 ft
+D+0.750Lr+0.450W	0.0000	in	0.000 ft	0.148	in	7.550 ft
+D+0.750S+0.450W	0.0000	in	0.000 ft	0.148	in	7.550 ft
+0.60D+0.60W	0.0000	in	0.000 ft	0.197	in	7.550 ft
+0.60D	0.0000	in	0.000 ft	0.000	in	0.000 ft
Lr Only	0.0000	in	0.000 ft	0.000	in	0.000 ft
S Only	0.0000	in	0.000 ft	0.000	in	0.000 ft
W Only	0.0000	in	0.000 ft	0.329	in	7.550 ft

Wood Column

Lic. # : KW-06007750

Description : 15 ft tall Engineered 2x6 wall studs @ 12" OC

Sketches



Project Title: Streets of West Pryor - Lot 3
 Engineer: Aaron M Scott
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Wall Footing

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Description : Trash Enclosure Footing

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16

Load Combinations Used : ASCE 7-10

General Information

Material Properties

f'_c : Concrete 28 day strength = 4.0 ksi
 f_y : Rebar Yield = 60.0 ksi
 E_c : Concrete Elastic Modulus = 3,122.0 ksi
 Concrete Density = 145.0 pcf
 ϕ Values Flexure = 0.90
 Shear = 0.750

Analysis Settings

Min Steel % Bending Reinf. =
 Min Allow % Temp Reinf. = 0.00180
 Min. Overturning Safety Factor = 1.0 : 1
 Min. Sliding Safety Factor = 1.0 : 1
 AutoCalc Footing Weight as DL : Yes

Soil Design Values

Allowable Soil Bearing = 2.50 ksf
 Increase Bearing By Footing Weight = No
 Soil Passive Resistance (for Sliding) = 250.0 pcf
 Soil/Concrete Friction Coeff. = 0.30

Increases based on footing Depth

Reference Depth below Surface = ft
 Allow. Pressure Increase per foot of depth = ksf
 when base footing is below = ft

Increases based on footing Width

Allow. Pressure Increase per foot of width = ksf
 when footing is wider than = ft

Adjusted Allowable Bearing Pressure

= 0.0 ksf

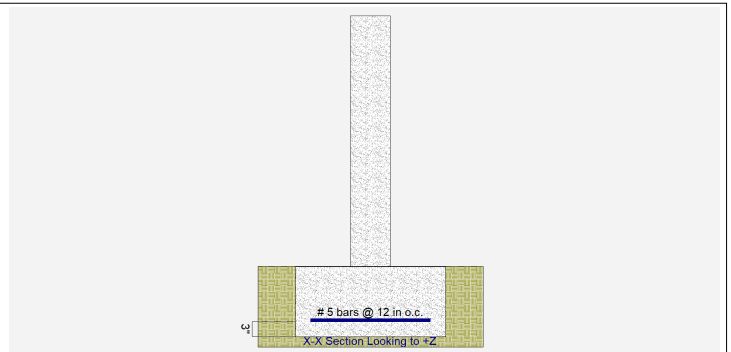
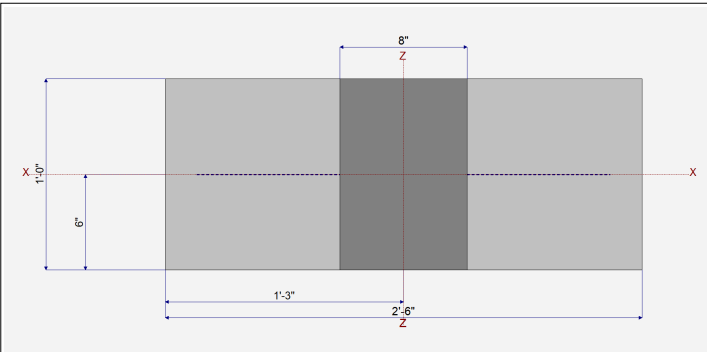
Dimensions

Footing Width = 2.50 ft
 Wall Thickness = 8.0 in
 Wall center offset from center of footing = 0 in

Footing Thickness = 14 in
 Rebar Centerline to Edge of Concrete... at Bottom of footing = 3.0 in

Reinforcing

Bars along X-X Axis
 Bar spacing = 12.00
 Reinforcing Bar Size = # 5



Applied Loads

	D	Lr	L	S	W	E	H	
P : Column Load	=	.416						k
OB : Overburden	=							ksf
V-x	=				0.1540			k
M-zz	=				0.690			k-ft
Vx applied	=							in above top of footing

Project Title: Streets of West Pryor - Lot 3
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Licensee : CERTUS STRUCTURAL ENGINEERS

Description : Trash Enclosure Footing

DESIGN SUMMARY

Design OK

Factor of Safety	Item	Applied	Capacity	Governing Load Combination
PASS	n/a	Overturning - Z-Z	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	No Uplift
Utilization Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.0	Soil Bearing	0.0 ksf	0.0
PASS	0.0	Z Flexure (+X)	0.0 k-ft	No Moment
PASS	0.0	Z Flexure (-X)	0.0 k-ft	No Moment
PASS	n/a	1-way Shear (+X)	0.0 psi	n/a
PASS	0.0	1-way Shear (-X)	0.0 psi	n/a

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Actual Soil Bearing -X	Stress +X	Actual / Allowable Ratio
--	-----------------	------	---------------------------	--------------	-----------------------------

Overturning Stability

Units : k-ft

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
--	--------------------	------------------	-----------------	--------

Footing Has NO Overturning

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio	Status
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Footing Has NO Sliding

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Which Side ?	Tension @ Bot. or Top ?	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
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One Way Shear

Units : k

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
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Description : 15 ft Shearwall Chord

Code References

Calculations per NDS 2015, IBC 2018, CBC 2019, ASCE 7-10

Load Combinations Used : ASCE 7-16

General Information

Analysis Method : Allowable Stress Design				Wood Section Name 3-2x8	
End Fixities Top & Bottom Pinned				Wood Grading/Manuf. Graded Lumber	
Overall Column Height		15.0 ft		Wood Member Type Sawn	
(Used for non-slender calculations)					
Wood Species Douglas Fir - Larch		Exact Width 4.50 in Allow Stress Modification Factors			
Wood Grade No.2		Exact Depth 7.250 in Cf or Cv for Bending 1.20			
Fb +	900.0 psi	Fv	180.0 psi	Area	32.625 in^2 Cf or Cv for Compression 1.050
Fb -	900.0 psi	Ft	575.0 psi	Ix	142.904 in^4 Cf or Cv for Tension 1.20
Fc - Prll	1,350.0 psi	Density	31.210 pcf	Iy	55.055 in^4 Cm : Wet Use Factor 1.0
Fc - Perp	625.0 psi				Ct : Temperature Factor 1.0
E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial		Cfu : Flat Use Factor 1.0
	Basic	1,600.0	1,600.0	1,600.0 ksi	Kf : Built-up columns 1.0 NDS 15.3.2
	Minimum	580.0	580.0		Use Cr : Repetitive ? No
Brace condition for deflection (buckling) along columns :					
				X-X (width) axis : Fully braced against buckling ABOUT Y-Y Axis	
				Y-Y (depth) axis : Lu for buckling ABOUT X-X Axis: K = 1.0	

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 106.065 lbs * Dead Load Factor

AXIAL LOADS . . .

Axial Load at 15.0 ft, W = 8.50 k

BENDING LOADS . . .

Lat. Uniform Load creating Mx-x, W = 0.0270 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio =	0.2251 : 1	Maximum SERVICE Lateral Load Reactions . .	
Load Combination	+D+0.60W	Top along Y-Y	0.0 k
Governing NDS Formula	Comp + Mxx, NDS Eq. 3.9-4	Bottom along Y-Y	0.0 k
Location of max.above base	0.1007 ft	Top along X-X	0.0 k
At maximum location values are . . .		Bottom along X-X	0.0 k
Applied Axial	5.206 k	Maximum SERVICE Load Lateral Deflections . . .	
Applied Mx	0.01215 k-ft	Along Y-Y	0.0 in at 7.550 ft above base
Applied My	0.0 k-ft	for load combination : W Only	
Fc : Allowable	708.97 psi	Along X-X	0.0 in at 0.0 ft above base
		for load combination : n/a	
PASS Maximum Shear Stress Ratio =	0.01940 : 1	Other Factors used to calculate allowable stresses . . .	
Load Combination	+D+0.60W	Bending	Compression
Location of max.above base	0.0 ft		Tension
Applied Design Shear	5.586 psi		
Allowable Shear	288.0 psi		

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
D Only	0.900	0.504	0.005057	PASS	0.0 ft	0.0	PASS	15.0 ft
+D+0.60W	1.600	0.313	0.2251	PASS	0.1007 ft	0.01940	PASS	0.0 ft
+D+0.450W	1.600	0.313	0.170	PASS	0.0 ft	0.01455	PASS	0.0 ft
+0.60D+0.60W	1.600	0.313	0.2232	PASS	0.0 ft	0.01940	PASS	0.0 ft
+0.60D	1.600	0.313	0.002751	PASS	0.0 ft	0.0	PASS	15.0 ft

Project Title: Streets of West Pryor - Lot 3
 Engineer: Aaron M Scott
 Project ID:
 Project Descr:

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Wood Column

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Description : 15 ft Shearwall Chord

Maximum Reactions

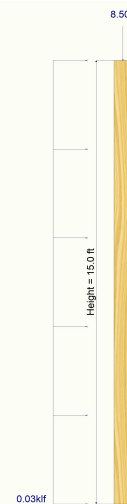
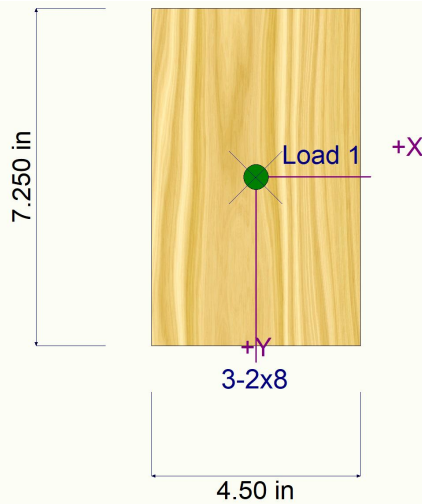
Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		k	Y-Y Axis Reaction		Axial Reaction	My - End Moments		k-ft	Mx - End Moments	
	@ Base	@ Top		@ Base	@ Top	@ Base	@ Base	@ Top		@ Base	@ Top
D Only						0.106					
+D+0.60W				0.122	0.121	5.206					
+D+0.450W				0.091	0.091	3.931					
+0.60D+0.60W				0.122	0.121	5.164					
+0.60D						0.064					
W Only				0.203	0.202	8.500					

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Distance	Max. Y-Y Deflection		Distance
D Only	0.0000	in	0.000	0.000	in	0.000
+D+0.60W	0.0000	in	0.000	0.082	in	7.550
+D+0.450W	0.0000	in	0.000	0.061	in	7.550
+0.60D+0.60W	0.0000	in	0.000	0.082	in	7.550
+0.60D	0.0000	in	0.000	0.000	in	0.000
W Only	0.0000	in	0.000	0.136	in	7.550

Sketches



Project Title: Streets of West Pryor - Lot 3
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General Footing

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Description : Interior Footing

Code References

Calculations per TMS 402-16, IBC 2018, CBC 2019, ASCE 7-16

Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'_c : Concrete 28 day strength = 4.0 ksi
 f_y : Rebar Yield = 60.0 ksi
 E_c : Concrete Elastic Modulus = 3,122.0 ksi
 Concrete Density = 145.0 pcf
 ϕ Values Flexure = 0.90
 Shear = 0.750

Analysis Settings

Min Steel % Bending Reinf. =
 Min Allow % Temp Reinf. =
 Min. Overturning Safety Factor = 1.0 : 1
 Min. Sliding Safety Factor = 1.0 : 1
 Add Ftg Wt for Soil Pressure : Yes
 Use ftg wt for stability, moments & shears : Yes
 Add Pedestal Wt for Soil Pressure : No
 Use Pedestal wt for stability, mom & shear : No

Soil Design Values

Allowable Soil Bearing = 3.0 ksf
 Increase Bearing By Footing Weight = No
 Soil Passive Resistance (for Sliding) = 250.0 pcf
 Soil/Concrete Friction Coeff. = 0.30

Increases based on footing Depth

Footing base depth below soil surface = ft
 Allow press. increase per foot of depth = ksf
 when footing base is below = ft

Increases based on footing plan dimension

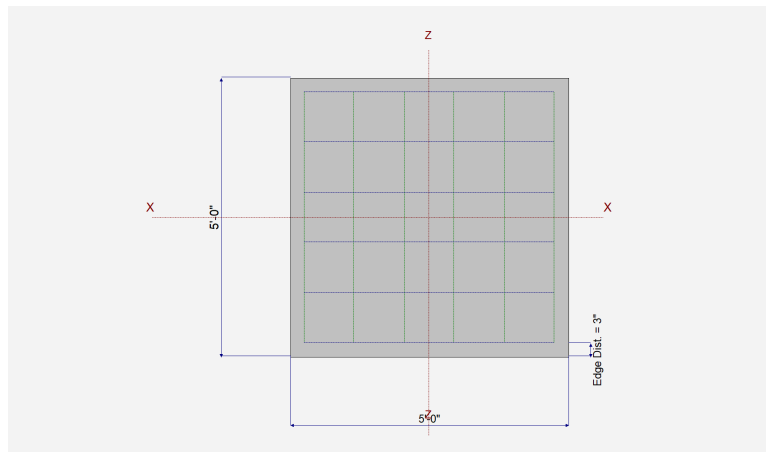
Allowable pressure increase per foot of depth = ksf
 when max. length or width is greater than = ft

Dimensions

Width parallel to X-X Axis = 5.0 ft
 Length parallel to Z-Z Axis = 5.0 ft
 Footing Thickness = 1.333 in

Pedestal dimensions...

px : parallel to X-X Axis = in
 pz : parallel to Z-Z Axis = in
 Height = in
 Rebar Centerline to Edge of Concrete...
 at Bottom of footing = 3.0 in



Reinforcing

Bars parallel to X-X Axis
 Number of Bars = 6.0
 Reinforcing Bar Size = # 5

Bars parallel to Z-Z Axis
 Number of Bars = 6.0
 Reinforcing Bar Size = # 5

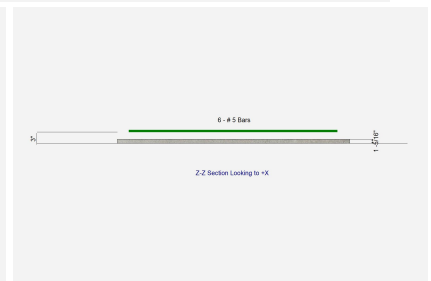
Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation

n/a

Bars required within zone n/a

Bars required on each side of zone n/a



Applied Loads

		D	Lr	L	S	W	E	H
P : Column Load	=	23	29.0					k
OB : Overburden	=							ksf
M-xx	=							k-ft
M-zz	=							k-ft
V-x	=							k
V-z	=							k

General Footing

Lic. # : KW-06007750

Description : Interior Footing

DESIGN SUMMARY

Design N.G.

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.6987	Soil Bearing	2.096 ksf	3.0 ksf	+D+Lr+H about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.0	Z Flexure (+X)	0.0 k-ft/ft	0.0 k-ft/ft	No Moment
PASS	0.0	Z Flexure (-X)	0.0 k-ft/ft	0.0 k-ft/ft	No Moment
PASS	0.0	X Flexure (+Z)	0.0 k-ft/ft	0.0 k-ft/ft	No Moment
PASS	0.0	X Flexure (-Z)	0.0 k-ft/ft	0.0 k-ft/ft	No Moment
FAIL	4.133	1-way Shear (+X)	392.122 psi	94.868 psi	+1.20D+1.60Lr+L+1.60H
FAIL	4.133	1-way Shear (-X)	392.122 psi	94.868 psi	+1.20D+1.60Lr+L+1.60H
FAIL	4.133	1-way Shear (+Z)	392.122 psi	94.868 psi	+1.20D+1.60Lr+L+1.60H
FAIL	4.133	1-way Shear (-Z)	392.122 psi	94.868 psi	+1.20D+1.60Lr+L+1.60H
FAIL	35.087	2-way Punching	6,657.34 psi	189.737 psi	+1.20D+1.60Lr+L+1.60H

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Zecc (in)	Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, +D+H	3.0	n/a	0.0	0.9361	0.9361	n/a	n/a	0.312
X-X, +D+L+H	3.0	n/a	0.0	0.9361	0.9361	n/a	n/a	0.312
X-X, +D+Lr+H	3.0	n/a	0.0	2.096	2.096	n/a	n/a	0.699
X-X, +D+S+H	3.0	n/a	0.0	0.9361	0.9361	n/a	n/a	0.312
X-X, +D+0.750Lr+0.750L+H	3.0	n/a	0.0	1.806	1.806	n/a	n/a	0.602
X-X, +D+0.750L+0.750S+H	3.0	n/a	0.0	0.9361	0.9361	n/a	n/a	0.312
X-X, +D+0.60W+H	3.0	n/a	0.0	0.9361	0.9361	n/a	n/a	0.312
X-X, +D+0.750Lr+0.450W+H	3.0	n/a	0.0	1.806	1.806	n/a	n/a	0.602
X-X, +D+0.750S+0.450W+H	3.0	n/a	0.0	0.9361	0.9361	n/a	n/a	0.312
X-X, +0.60D+0.60W+0.60H	3.0	n/a	0.0	0.5617	0.5617	n/a	n/a	0.187
X-X, +D+0.70E+0.60H	3.0	n/a	0.0	0.9361	0.9361	n/a	n/a	0.312
X-X, +D+0.750L+0.750S+0.5250E+H	3.0	n/a	0.0	0.9361	0.9361	n/a	n/a	0.312
X-X, +0.60D+0.70E+H	3.0	n/a	0.0	0.5617	0.5617	n/a	n/a	0.187
Z-Z, +D+H	3.0	0.0	n/a	n/a	n/a	0.9361	0.9361	0.312
Z-Z, +D+L+H	3.0	0.0	n/a	n/a	n/a	0.9361	0.9361	0.312
Z-Z, +D+Lr+H	3.0	0.0	n/a	n/a	n/a	2.096	2.096	0.699
Z-Z, +D+S+H	3.0	0.0	n/a	n/a	n/a	0.9361	0.9361	0.312
Z-Z, +D+0.750Lr+0.750L+H	3.0	0.0	n/a	n/a	n/a	1.806	1.806	0.602
Z-Z, +D+0.750L+0.750S+H	3.0	0.0	n/a	n/a	n/a	0.9361	0.9361	0.312
Z-Z, +D+0.60W+H	3.0	0.0	n/a	n/a	n/a	0.9361	0.9361	0.312
Z-Z, +D+0.750Lr+0.450W+H	3.0	0.0	n/a	n/a	n/a	1.806	1.806	0.602
Z-Z, +D+0.750S+0.450W+H	3.0	0.0	n/a	n/a	n/a	0.9361	0.9361	0.312
Z-Z, +0.60D+0.60W+0.60H	3.0	0.0	n/a	n/a	n/a	0.5617	0.5617	0.187
Z-Z, +D+0.70E+0.60H	3.0	0.0	n/a	n/a	n/a	0.9361	0.9361	0.312
Z-Z, +D+0.750L+0.750S+0.5250E+H	3.0	0.0	n/a	n/a	n/a	0.9361	0.9361	0.312
Z-Z, +0.60D+0.70E+H	3.0	0.0	n/a	n/a	n/a	0.5617	0.5617	0.187

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

All units k

General Footing

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Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in ²	Gvrn. As in ²	Actual As in ²	Phi*Mn k-ft	Status
X-X, +1.40D+1.60H	4.025	+Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +1.40D+1.60H	4.025	-Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +1.20D+0.50Lr+1.60L+1.60H	5.263	+Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +1.20D+0.50Lr+1.60L+1.60H	5.263	-Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +1.20D+1.60L+0.50S+1.60H	3.450	+Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +1.20D+1.60L+0.50S+1.60H	3.450	-Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +1.20D+1.60Lr+L+1.60H	9.250	+Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +1.20D+1.60Lr+L+1.60H	9.250	-Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +1.20D+1.60Lr+0.50W+1.60H	9.250	+Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +1.20D+1.60Lr+0.50W+1.60H	9.250	-Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +1.20D+L+1.60S+1.60H	3.450	+Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +1.20D+L+1.60S+1.60H	3.450	-Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +1.20D+1.60S+0.50W+1.60H	3.450	+Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +1.20D+1.60S+0.50W+1.60H	3.450	-Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +1.20D+0.50Lr+L+W+1.60H	5.263	+Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +1.20D+0.50Lr+L+W+1.60H	5.263	-Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +1.20D+L+0.50S+W+1.60H	3.450	+Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +1.20D+L+0.50S+W+1.60H	3.450	-Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +0.90D+W+1.60H	2.588	+Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +0.90D+W+1.60H	2.588	-Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +1.20D+L+0.20S+E+1.90H	3.450	+Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +1.20D+L+0.20S+E+1.90H	3.450	-Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +0.90D+E+0.90H	2.588	+Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
X-X, +0.90D+E+0.90H	2.588	-Z	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +1.40D+1.60H	4.025	-X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +1.40D+1.60H	4.025	+X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +1.20D+0.50Lr+1.60L+1.60H	5.263	-X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +1.20D+0.50Lr+1.60L+1.60H	5.263	+X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +1.20D+1.60L+0.50S+1.60H	3.450	-X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +1.20D+1.60L+0.50S+1.60H	3.450	+X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +1.20D+1.60Lr+L+1.60H	9.250	-X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +1.20D+1.60Lr+L+1.60H	9.250	+X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +1.20D+1.60Lr+0.50W+1.60H	9.250	-X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +1.20D+1.60Lr+0.50W+1.60H	9.250	+X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +1.20D+L+1.60S+1.60H	3.450	-X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +1.20D+L+1.60S+1.60H	3.450	+X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +1.20D+1.60S+0.50W+1.60H	3.450	-X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +1.20D+1.60S+0.50W+1.60H	3.450	+X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +1.20D+0.50Lr+L+W+1.60H	5.263	-X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +1.20D+0.50Lr+L+W+1.60H	5.263	+X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +1.20D+L+0.50S+W+1.60H	3.450	-X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +1.20D+L+0.50S+W+1.60H	3.450	+X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +0.90D+W+1.60H	2.588	-X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +0.90D+W+1.60H	2.588	+X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +1.20D+L+0.20S+E+1.90H	3.450	-X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +1.20D+L+0.20S+E+1.90H	3.450	+X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +0.90D+E+0.90H	2.588	-X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK
Z-Z, +0.90D+E+0.90H	2.588	+X	Bottom	0.0 As Req'd > Max Allo		0.3720	0.0	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D+1.60H	170.63 psi	170.63 psi	170.63 psi	170.63 psi	170.63 psi	94.87 psi	1.80	No Good!
+1.20D+0.50Lr+1.60L+1.60H	223.09 psi	223.09 psi	223.09 psi	223.09 psi	223.09 psi	94.87 psi	2.35	No Good!
+1.20D+1.60L+0.50S+1.60H	146.25 psi	146.25 psi	146.25 psi	146.25 psi	146.25 psi	94.87 psi	1.54	No Good!
+1.20D+1.60Lr+L+1.60H	392.12 psi	392.12 psi	392.12 psi	392.12 psi	392.12 psi	94.87 psi	4.13	No Good!
+1.20D+1.60Lr+0.50W+1.60H	392.12 psi	392.12 psi	392.12 psi	392.12 psi	392.12 psi	94.87 psi	4.13	No Good!
+1.20D+L+1.60S+1.60H	146.25 psi	146.25 psi	146.25 psi	146.25 psi	146.25 psi	94.87 psi	1.54	No Good!
+1.20D+1.60S+0.50W+1.60H	146.25 psi	146.25 psi	146.25 psi	146.25 psi	146.25 psi	94.87 psi	1.54	No Good!
+1.20D+0.50Lr+L+W+1.60H	223.09 psi	223.09 psi	223.09 psi	223.09 psi	223.09 psi	94.87 psi	2.35	No Good!
+1.20D+L+0.50S+W+1.60H	146.25 psi	146.25 psi	146.25 psi	146.25 psi	146.25 psi	94.87 psi	1.54	No Good!
+0.90D+W+1.60H	109.69 psi	109.69 psi	109.69 psi	109.69 psi	109.69 psi	94.87 psi	1.16	No Good!

Project Title: Streets of West Pryor - Lot 3
 Engineer: Aaron M Scott
 Project ID:
 Project Descr:

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General Footing

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Description : Interior Footing

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.20D+L+0.20S+E+1.90H	146.25 psi	146.25 psi	146.25 psi	146.25 psi	146.25 psi	94.87 psi	1.54	No Good!
+0.90D+E+0.90H	109.69 psi	109.69 psi	109.69 psi	109.69 psi	109.69 psi	94.87 psi	1.16	No Good!

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D+1.60H	2.00 psi	189.74 psi	15.268	No Good!
+1.20D+0.50Lr+1.60L+1.60H	3.00 psi	189.74 psi	19.962	No Good!
+1.20D+1.60L+0.50S+1.60H	2.00 psi	189.74 psi	13.087	No Good!
+1.20D+1.60Lr+L+1.60H	6.00 psi	189.74 psi	35.087	No Good!
+1.20D+1.60Lr+0.50W+1.60H	6.00 psi	189.74 psi	35.087	No Good!
+1.20D+L+1.60S+1.60H	2.00 psi	189.74 psi	13.087	No Good!
+1.20D+1.60S+0.50W+1.60H	2.00 psi	189.74 psi	13.087	No Good!
+1.20D+0.50Lr+L+W+1.60H	3.00 psi	189.74 psi	19.962	No Good!
+1.20D+L+0.50S+W+1.60H	2.00 psi	189.74 psi	13.087	No Good!
+0.90D+W+1.60H	1.00 psi	189.74 psi	9.815	No Good!
+1.20D+L+0.20S+E+1.90H	2.00 psi	189.74 psi	13.087	No Good!
+0.90D+E+0.90H	1.00 psi	189.74 psi	9.815	No Good!

Project Title: Streets of West Pryor - Lot 3
 Engineer: Aaron M Scott
 Project ID:
 Project Descr:

**RELEASE FOR
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07/16/2020

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General Footing

ryor\01190008.110 - Streets of West Pryor - Lot 3\Calculations\01190008.110 - Streets of West Pryor - Lot 3.ec6 .

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Lic. # : KW-06007750

Licensee : CERTUS STRUCTURAL ENGINEERS

Description : Exterior Footing

Code References

Calculations per TMS 402-16, IBC 2018, CBC 2019, ASCE 7-16

Load Combinations Used : ASCE 7-16

General Information

Material Properties

f _c : Concrete 28 day strength	=	4.0	ksi
f _y : Rebar Yield	=	60.0	ksi
E _c : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	145.0	pcf
φ Values Flexure	=	0.90	
Shear	=	0.750	

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Soil Design Values

Allowable Soil Bearing	=	3.0	ksf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.30	

Increases based on footing Depth

Footing base depth below soil surface	=		ft
Allow press. increase per foot of depth	=		ksf
when footing base is below	=		ft

Increases based on footing plan dimension

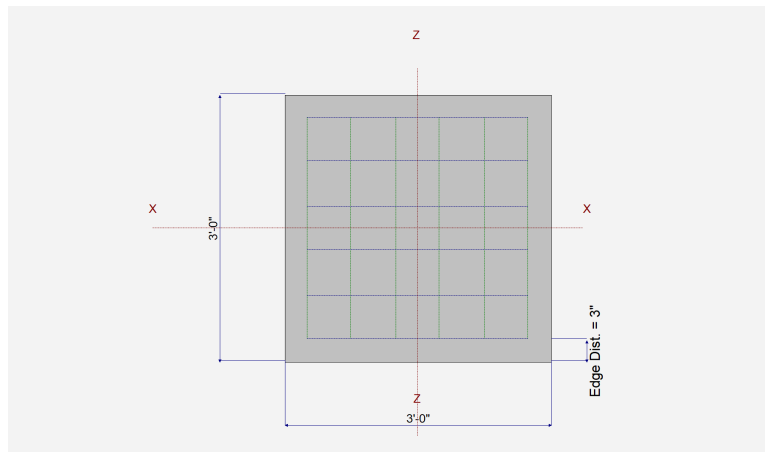
Allowable pressure increase per foot of depth	=		ksf
when max. length or width is greater than	=		ft

Dimensions

Width parallel to X-X Axis	=	3.0	ft
Length parallel to Z-Z Axis	=	3.0	ft
Footing Thickness	=	36.0	in

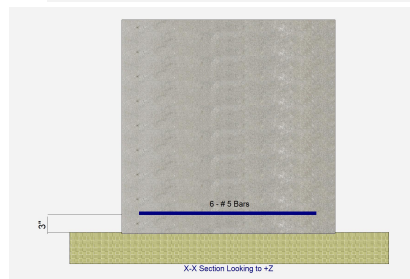
Pedestal dimensions...

px : parallel to X-X Axis	=		in
pz : parallel to Z-Z Axis	=		in
Height	=		in
Rebar Centerline to Edge of Concrete... at Bottom of footing	=	3.0	in



Reinforcing

Bars parallel to X-X Axis	=	
Number of Bars	=	6.0
Reinforcing Bar Size	=	# 5
Bars parallel to Z-Z Axis	=	
Number of Bars	=	6.0
Reinforcing Bar Size	=	# 5
Bandwidth Distribution Check (ACI 15.4.4.2)		
Direction Requiring Closer Separation		
# Bars required within zone		n/a
# Bars required on each side of zone		n/a



Applied Loads

		D	Lr	L	S	W	E	H
P : Column Load	=	9	12.0			-5.0		k
OB : Overburden	=							ksf
M-xx	=							k-ft
M-zz	=							k-ft
V-x	=							k
V-z	=							k

General Footing

Lic. # : KW-06007750

Description : Exterior Footing

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.9227	Soil Bearing	2.768 ksf	3.0 ksf	+D+Lr+H about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	2.583	Uplift	-3.0 k	7.749 k	+0.60D+0.60W+0.60H
PASS	0.04130	Z Flexure (+X)	3.750 k-ft/ft	90.798 k-ft/ft	+1.20D+1.60Lr+L+1.60H
PASS	0.04130	Z Flexure (-X)	3.750 k-ft/ft	90.798 k-ft/ft	+1.20D+1.60Lr+L+1.60H
PASS	0.04130	X Flexure (+Z)	3.750 k-ft/ft	90.798 k-ft/ft	+1.20D+1.60Lr+L+1.60H
PASS	0.04130	X Flexure (-Z)	3.750 k-ft/ft	90.798 k-ft/ft	+1.20D+1.60Lr+L+1.60H
PASS	n/a	1-way Shear (+X)	0.0 psi	94.868 psi	n/a
PASS	0.0	1-way Shear (-X)	0.0 psi	0.0 psi	n/a
PASS	n/a	1-way Shear (+Z)	0.0 psi	94.868 psi	n/a
PASS	n/a	1-way Shear (-Z)	0.0 psi	94.868 psi	n/a
PASS	n/a	2-way Punching	1.058 psi	94.868 psi	+1.20D+1.60Lr+L+1.60H

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Zecc (in)	Actual Soil Bearing Stress @ Location				Actual / Allow Ratio
				Bottom, -Z	Top, +Z	Left, -X	Right, +X	
X-X, +D+H	3.0	n/a	0.0	1.435	1.435	n/a	n/a	0.478
X-X, +D+L+H	3.0	n/a	0.0	1.435	1.435	n/a	n/a	0.478
X-X, +D+Lr+H	3.0	n/a	0.0	2.768	2.768	n/a	n/a	0.923
X-X, +D+S+H	3.0	n/a	0.0	1.435	1.435	n/a	n/a	0.478
X-X, +D+0.750Lr+0.750L+H	3.0	n/a	0.0	2.435	2.435	n/a	n/a	0.812
X-X, +D+0.750L+0.750S+H	3.0	n/a	0.0	1.435	1.435	n/a	n/a	0.478
X-X, +D+0.60W+H	3.0	n/a	0.0	1.102	1.102	n/a	n/a	0.367
X-X, +D+0.750Lr+0.450W+H	3.0	n/a	0.0	2.185	2.185	n/a	n/a	0.728
X-X, +D+0.750S+0.450W+H	3.0	n/a	0.0	1.185	1.185	n/a	n/a	0.395
X-X, +0.60D+0.60W+0.60H	3.0	n/a	0.0	0.5277	0.5277	n/a	n/a	0.176
X-X, +D+0.70E+0.60H	3.0	n/a	0.0	1.435	1.435	n/a	n/a	0.478
X-X, +D+0.750L+0.750S+0.5250E+H	3.0	n/a	0.0	1.435	1.435	n/a	n/a	0.478
X-X, +0.60D+0.70E+H	3.0	n/a	0.0	0.8610	0.8610	n/a	n/a	0.287
Z-Z, +D+H	3.0	0.0	n/a	n/a	n/a	1.435	1.435	0.478
Z-Z, +D+L+H	3.0	0.0	n/a	n/a	n/a	1.435	1.435	0.478
Z-Z, +D+Lr+H	3.0	0.0	n/a	n/a	n/a	2.768	2.768	0.923
Z-Z, +D+S+H	3.0	0.0	n/a	n/a	n/a	1.435	1.435	0.478
Z-Z, +D+0.750Lr+0.750L+H	3.0	0.0	n/a	n/a	n/a	2.435	2.435	0.812
Z-Z, +D+0.750L+0.750S+H	3.0	0.0	n/a	n/a	n/a	1.435	1.435	0.478
Z-Z, +D+0.60W+H	3.0	0.0	n/a	n/a	n/a	1.102	1.102	0.367
Z-Z, +D+0.750Lr+0.450W+H	3.0	0.0	n/a	n/a	n/a	2.185	2.185	0.728
Z-Z, +D+0.750S+0.450W+H	3.0	0.0	n/a	n/a	n/a	1.185	1.185	0.395
Z-Z, +0.60D+0.60W+0.60H	3.0	0.0	n/a	n/a	n/a	0.5277	0.5277	0.176
Z-Z, +D+0.70E+0.60H	3.0	0.0	n/a	n/a	n/a	1.435	1.435	0.478
Z-Z, +D+0.750L+0.750S+0.5250E+H	3.0	0.0	n/a	n/a	n/a	1.435	1.435	0.478
Z-Z, +0.60D+0.70E+H	3.0	0.0	n/a	n/a	n/a	0.8610	0.8610	0.287

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

All units k

Project Title: Streets of West Pryor - Lot 3
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General Footing

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Description : Exterior Footing

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in ²	Gvrn. As in ²	Actual As in ²	Phi*Mn k-ft	Status
X-X, +1.40D+1.60H	1.575	+Z	Bottom	0.01061	Min for Bending	0.620	90.798	OK
X-X, +1.40D+1.60H	1.575	-Z	Bottom	0.01061	Min for Bending	0.620	90.798	OK
X-X, +1.20D+0.50Lr+1.60L+1.60H	2.10	+Z	Bottom	0.01415	Min for Bending	0.620	90.798	OK
X-X, +1.20D+0.50Lr+1.60L+1.60H	2.10	-Z	Bottom	0.01415	Min for Bending	0.620	90.798	OK
X-X, +1.20D+1.60L+0.50S+1.60H	1.350	+Z	Bottom	0.009093	Min for Bending	0.620	90.798	OK
X-X, +1.20D+1.60L+0.50S+1.60H	1.350	-Z	Bottom	0.009093	Min for Bending	0.620	90.798	OK
X-X, +1.20D+1.60Lr+L+1.60H	3.750	+Z	Bottom	0.02527	Min for Bending	0.620	90.798	OK
X-X, +1.20D+1.60Lr+L+1.60H	3.750	-Z	Bottom	0.02527	Min for Bending	0.620	90.798	OK
X-X, +1.20D+1.60Lr+0.50W+1.60H	3.438	+Z	Bottom	0.02316	Min for Bending	0.620	90.798	OK
X-X, +1.20D+1.60Lr+0.50W+1.60H	3.438	-Z	Bottom	0.02316	Min for Bending	0.620	90.798	OK
X-X, +1.20D+L+1.60S+1.60H	1.350	+Z	Bottom	0.009093	Min for Bending	0.620	90.798	OK
X-X, +1.20D+L+1.60S+1.60H	1.350	-Z	Bottom	0.009093	Min for Bending	0.620	90.798	OK
X-X, +1.20D+1.60S+0.50W+1.60H	1.038	+Z	Bottom	0.006988	Min for Bending	0.620	90.798	OK
X-X, +1.20D+1.60S+0.50W+1.60H	1.038	-Z	Bottom	0.006988	Min for Bending	0.620	90.798	OK
X-X, +1.20D+0.50Lr+L+W+1.60H	1.475	+Z	Bottom	0.009935	Min for Bending	0.620	90.798	OK
X-X, +1.20D+0.50Lr+L+W+1.60H	1.475	-Z	Bottom	0.009935	Min for Bending	0.620	90.798	OK
X-X, +1.20D+L+0.50S+W+1.60H	0.7250	+Z	Bottom	0.004883	Min for Bending	0.620	90.798	OK
X-X, +1.20D+L+0.50S+W+1.60H	0.7250	-Z	Bottom	0.004883	Min for Bending	0.620	90.798	OK
X-X, +0.90D+W+1.60H	0.3875	+Z	Bottom	0.002610	Min for Bending	0.620	90.798	OK
X-X, +0.90D+W+1.60H	0.3875	-Z	Bottom	0.002610	Min for Bending	0.620	90.798	OK
X-X, +1.20D+L+0.20S+E+1.90H	1.350	+Z	Bottom	0.009093	Min for Bending	0.620	90.798	OK
X-X, +1.20D+L+0.20S+E+1.90H	1.350	-Z	Bottom	0.009093	Min for Bending	0.620	90.798	OK
X-X, +0.90D+E+0.90H	1.013	+Z	Bottom	0.006819	Min for Bending	0.620	90.798	OK
X-X, +0.90D+E+0.90H	1.013	-Z	Bottom	0.006819	Min for Bending	0.620	90.798	OK
Z-Z, +1.40D+1.60H	1.575	-X	Bottom	0.01061	Min for Bending	0.620	90.798	OK
Z-Z, +1.40D+1.60H	1.575	+X	Bottom	0.01061	Min for Bending	0.620	90.798	OK
Z-Z, +1.20D+0.50Lr+1.60L+1.60H	2.10	-X	Bottom	0.01415	Min for Bending	0.620	90.798	OK
Z-Z, +1.20D+0.50Lr+1.60L+1.60H	2.10	+X	Bottom	0.01415	Min for Bending	0.620	90.798	OK
Z-Z, +1.20D+1.60L+0.50S+1.60H	1.350	-X	Bottom	0.009093	Min for Bending	0.620	90.798	OK
Z-Z, +1.20D+1.60L+0.50S+1.60H	1.350	+X	Bottom	0.009093	Min for Bending	0.620	90.798	OK
Z-Z, +1.20D+1.60Lr+L+1.60H	3.750	-X	Bottom	0.02527	Min for Bending	0.620	90.798	OK
Z-Z, +1.20D+1.60Lr+L+1.60H	3.750	+X	Bottom	0.02527	Min for Bending	0.620	90.798	OK
Z-Z, +1.20D+1.60Lr+0.50W+1.60H	3.438	-X	Bottom	0.02316	Min for Bending	0.620	90.798	OK
Z-Z, +1.20D+1.60Lr+0.50W+1.60H	3.438	+X	Bottom	0.02316	Min for Bending	0.620	90.798	OK
Z-Z, +1.20D+L+1.60S+1.60H	1.350	-X	Bottom	0.009093	Min for Bending	0.620	90.798	OK
Z-Z, +1.20D+L+1.60S+1.60H	1.350	+X	Bottom	0.009093	Min for Bending	0.620	90.798	OK
Z-Z, +1.20D+1.60S+0.50W+1.60H	1.038	-X	Bottom	0.006988	Min for Bending	0.620	90.798	OK
Z-Z, +1.20D+1.60S+0.50W+1.60H	1.038	+X	Bottom	0.006988	Min for Bending	0.620	90.798	OK
Z-Z, +1.20D+0.50Lr+L+W+1.60H	1.475	-X	Bottom	0.009935	Min for Bending	0.620	90.798	OK
Z-Z, +1.20D+0.50Lr+L+W+1.60H	1.475	+X	Bottom	0.009935	Min for Bending	0.620	90.798	OK
Z-Z, +1.20D+L+0.50S+W+1.60H	0.7250	-X	Bottom	0.004883	Min for Bending	0.620	90.798	OK
Z-Z, +1.20D+L+0.50S+W+1.60H	0.7250	+X	Bottom	0.004883	Min for Bending	0.620	90.798	OK
Z-Z, +0.90D+W+1.60H	0.3875	-X	Bottom	0.002610	Min for Bending	0.620	90.798	OK
Z-Z, +0.90D+W+1.60H	0.3875	+X	Bottom	0.002610	Min for Bending	0.620	90.798	OK
Z-Z, +1.20D+L+0.20S+E+1.90H	1.350	-X	Bottom	0.009093	Min for Bending	0.620	90.798	OK
Z-Z, +1.20D+L+0.20S+E+1.90H	1.350	+X	Bottom	0.009093	Min for Bending	0.620	90.798	OK
Z-Z, +0.90D+E+0.90H	1.013	-X	Bottom	0.006819	Min for Bending	0.620	90.798	OK
Z-Z, +0.90D+E+0.90H	1.013	+X	Bottom	0.006819	Min for Bending	0.620	90.798	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D+1.60H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK
+1.20D+0.50Lr+1.60L+1.60H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK
+1.20D+1.60L+0.50S+1.60H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK
+1.20D+1.60Lr+L+1.60H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK
+1.20D+1.60Lr+0.50W+1.60H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK
+1.20D+L+1.60S+1.60H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK
+1.20D+1.60S+0.50W+1.60H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK
+1.20D+0.50Lr+L+W+1.60H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK
+1.20D+L+0.50S+W+1.60H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK
+0.90D+W+1.60H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK

Project Title: Streets of West Pryor - Lot 3
 Engineer: Aaron M Scott
 Project ID:
 Project Descr:

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General Footing

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Description : Exterior Footing

One Way Shear

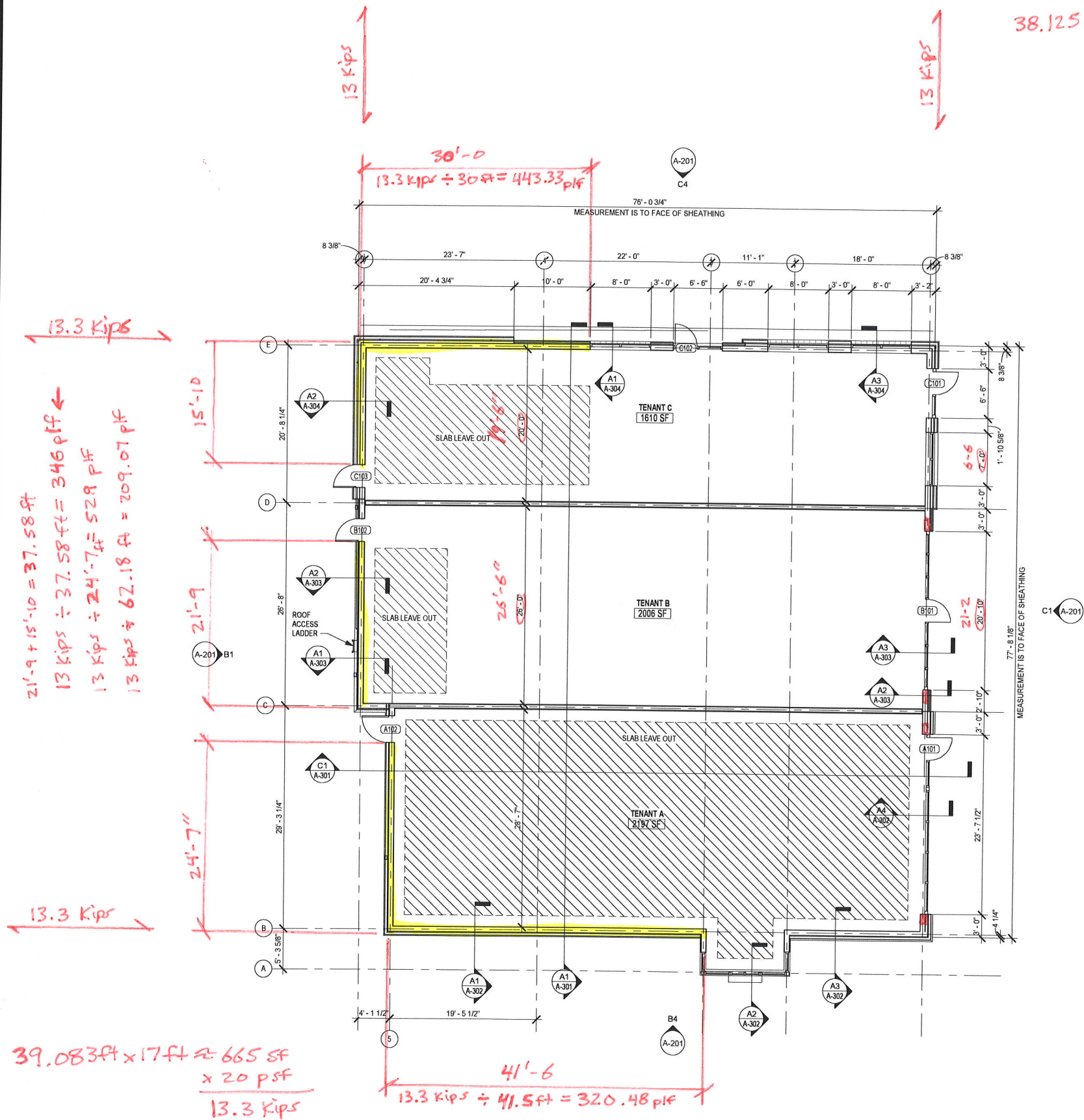
Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.20D+L+0.20S+E+1.90H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK
+0.90D+E+0.90H	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK

Two-Way "Punching" Shear

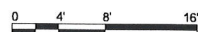
All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D+1.60H	0.44 psi	189.74 psi	0.002342	OK
+1.20D+0.50Lr+1.60L+1.60H	0.59 psi	189.74 psi	0.003122	OK
+1.20D+1.60L+0.50S+1.60H	0.38 psi	189.74 psi	0.002007	OK
+1.20D+1.60Lr+L+1.60H	1.06 psi	189.74 psi	0.005575	OK
+1.20D+1.60Lr+0.50W+1.60H	0.97 psi	189.74 psi	0.005111	OK
+1.20D+L+1.60S+1.60H	0.38 psi	189.74 psi	0.002007	OK
+1.20D+1.60S+0.50W+1.60H	0.29 psi	189.74 psi	0.001543	OK
+1.20D+0.50Lr+L+W+1.60H	0.42 psi	189.74 psi	0.002193	OK
+1.20D+L+0.50S+W+1.60H	0.20 psi	189.74 psi	0.001078	OK
+0.90D+W+1.60H	0.11 psi	189.74 psi	0.000576	OK
+1.20D+L+0.20S+E+1.90H	0.38 psi	189.74 psi	0.002007	OK
+0.90D+E+0.90H	0.29 psi	189.74 psi	0.001505	OK

FILEPATH: F:\1 Projects SDG\190224 Streets of West Pryor - Lot #305 Drawings\Revit\190224 West Pryor Lot 3 V3.rvt
DATE: 12/27/2020 11:40:29 AM
DRAWN BY: Admin



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



SW w/ Panel Edge Fasteners @ 6" oc = 340 plf
@ 4" oc = 495 plf
@ 3" oc = 637 plf

RELEASE FOR
CONSTRUCTION
AS NOTED ON PLANS REVIEW
DEVELOPMENT SERVICES
LEE'S SUMMIT, MISSOURI

07/16/2020

schwerdt design group
architecture | interiors | planning
2231 sw wanamaker rd suite 303
topeka, kansas 66614-4275
phone: 785.273.7540
500 north broadway suite 200
oklahoma city, ok 73102
phone: 405.231.3105

PROGRESS PRINT

NOT FOR
CONSTRUCTION

DATE: 00/00/00

**MULTI-TENANT BUILDING
STREETS OF WEST PRYOR, LOT 3
LEE'S SUMMIT, MO**

SUBMISSION DATES
PROGRESS PRINT ONLY

SHEET TITLE
FIRST FLOOR PLAN

PROJECT NUMBER
190224

SHEET NUMBER
A-101

DRAWINGS ARE PRELIMINARY / SCHEMATIC. LAYOUT AND SECTIONS ARE
RELATIVE TO COMMUNICATIONS TO DATE WITH CONSULTANTS AND
DESIGN TEAM. SUBJECT TO VERIFICATION AND CHANGES ONCE MORE
INFORMATION FROM DESIGN TEAM IS PROVIDED.



CAST-IN-PLACE CONCRETE

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement.

1.3 INFORMATIONAL SUBMITTALS

- A. Material certificates.
- B. Material test reports.
- C. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.
- D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.

CAST-IN-PLACE CONCRETE

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.6 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1.
 - 1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301.
 - 2. ACI 117.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- C. Galvanized Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed bars, ASTM A767/A767M, zinc coated after fabrication and bending.
- D. Epoxy-Coated Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed bars, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.

CAST-IN-PLACE CONCRETE

- E. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- F. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.
- G. Galvanized-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from galvanized-steel wire into flat sheets.
- H. Epoxy-Coated Welded-Wire Reinforcement: ASTM A884/A884M, Class A coated, Type 1, steel.
- I. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

2.4 CONCRETE MATERIALS

- A. Cementitious Materials:
 - 1. Portland Cement: ASTM C150/C150M, Type I, gray.
 - 2. Fly Ash: ASTM C618, Class F or C.
 - 3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C33/C33M, graded.
 - 1. Maximum Coarse-Aggregate Size: Refer to Construction Documents.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Air-Entraining Admixture: ASTM C260/C260M.
- D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
 - 2. Retarding Admixture: ASTM C494/C494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
- E. Water: ASTM C94/C94M and potable.

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CAST-IN-PLACE CONCRETE

2.5 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
- B. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
- C. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.
- D. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.

2.6 VAPOR RETARDERS

- A. Sheet Vapor Retarder: Polyethylene sheet, ASTM D4397, not less than 6 mils thick.

2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

2.8 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.

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CAST-IN-PLACE CONCRETE

2.9 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing, high-range water-reducing or, plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.10 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Normal-Weight Concrete:
 - 1. Minimum Compressive Strength: Refer to Construction Documents, at 28 days.
 - 2. Maximum W/C Ratio: Refer to Construction Documents.
 - 3. Slump Limit: Refer to Construction Documents.
 - 4. Air Content: Refer to Construction Documents.
 - 5. Air Content: Refer to Construction Documents.
 - 6. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.11 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M and ASTM C1116/C1116M, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Chamfer exterior corners and edges of permanently exposed concrete.

3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.4 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

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1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

3.6 WATERSTOP INSTALLATION

- A. Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3.8 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture

matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
 - 1. Apply float finish to surfaces to receive trowel finish.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - 2. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.
- D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

CAST-IN-PLACE CONCRETE

- D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.11 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.12 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

END OF SECTION 033000

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CONCRETE UNIT MASONRY

SECTION 042200 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Steel reinforcing bars.

1.2 ACTION SUBMITTALS

- ###### A. Shop Drawings:
- For reinforcing steel. Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.

1.3 FIELD CONDITIONS

- ###### A. Cold-Weather Requirements:
- Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
- ###### B. Hot-Weather Requirements:
- Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

- ###### A. Masonry Standard:
- Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.
- ###### B. Defective Units:
- Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

2.2 CONCRETE MASONRY UNITS

A. CMUs: ASTM C90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
2. Density Classification: Lightweight unless otherwise indicated.

CONCRETE UNIT MASONRY

2.3 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C91/C91M.
- E. Aggregate for Mortar: ASTM C144.
 - 1. Aggregates: Natural sand or crushed stone.
- F. Aggregate for Grout: ASTM C404.
- G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- H. Water: Potable.

2.4 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
- C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.
 - 1. Exterior Walls: Hot-dip galvanized carbon steel.
 - 2. Wire Size for Side Rods: 0.148-inch diameter.
 - 3. Wire Size for Cross Rods: 0.148-inch diameter.
 - 4. Spacing of Cross Rods: Not more than 16 inches o.c.
 - 5. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

2.5 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.

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2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
3. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

- B. Partition Top Anchors: 0.105-inch-thick metal plate with a 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

2.6 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch thick.
2. Copper: ASTM B370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. weight or 0.0216 inch thick or ASTM B370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. weight or 0.0162 inch thick.
3. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
4. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
5. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
6. Fabricate metal expansion-joint strips to shapes indicated.

- B. Flexible Flashing: Use one of the following unless otherwise indicated:

1. Copper-Laminated Flashing: 5-oz./sq. ft. copper sheet bonded between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
2. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch.
3. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.030 inch.
4. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.
5. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D4637/D4637M, 0.040 inch thick.

CONCRETE UNIT MASONRY

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- C. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from UV-resistant, high-density polyethylene. Cell flashing pans have integral weep spouts designed to be built into mortar bed joints and that extend into the cell to prevent clogging with mortar.
- D. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."
- E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 or PVC, complying with ASTM D2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

2.8 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C270.
- D. Grout for Unit Masonry: Comply with ASTM C476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.2 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.3 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- D. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- E. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
 - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
- B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.5 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

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- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

3.6 FLASHING

- A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.
- B. Install flashing as follows unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
- C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

3.7 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
 - 1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 - 2. Limit height of vertical grout pours to not more than 60 inches.

3.8 REPAIRING, POINTING, AND CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

CONCRETE UNIT MASONRY

- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
 2. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.9 MASONRY WASTE DISPOSAL

- A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
1. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

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MASONRY VENEER

SECTION 042613 - MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Clay face brick.
2. Flashing

B. Products Installed but Not Furnished under This Section:

1. Steel lintels in masonry veneer.
2. Steel shelf angles for supporting masonry veneer.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type and color of brick.

1.3 FIELD CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

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- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects will be exposed in the completed Work.

2.2 BRICK

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Clay Face Brick: Facing brick complying with ASTM C216 or hollow brick complying with ASTM C652, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area).
1. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C67.
 2. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."
 3. Surface Coating: Brick with colors or textures produced by application of coatings shall withstand 50 cycles of freezing and thawing according to ASTM C67 with no observable difference in the applied finish when viewed from 10 feet or shall have a history of successful use in Project's area.
 4. Size (Actual Dimensions): 3-1/2 inches wide by 2-1/4 inches high by 7-1/2 inches long or 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
 5. Color and Texture: As selected by Architect.
 - a. Color 1: **Mutual Materials – Coal Creek**

2.3 MORTAR MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Masonry Cement: ASTM C91/C91M.
- E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.

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- F. Colored Cement Products: Packaged blend made from portland cement and hydrated lime, masonry cement, or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
1. Colored Portland Cement-Lime Mix:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Lafarge North America Inc.
 - 2) Lehigh Hanson; HeidelbergCement Group.
 2. Colored Masonry Cement:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Lafarge North America Inc.
 - 2) Lehigh Hanson; HeidelbergCement Group.
- G. Aggregate for Mortar: ASTM C144.
1. White-Mortar Aggregates: Natural white sand or crushed white stone.
 2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
 - a. Mortar color: **SM770 Sable**
- H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete bricks containing integral water repellent from same manufacturer.
- J. Water: Potable.

2.4 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.
 2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.

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- C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized-steel wire.
 - 2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- diameter, hot-dip galvanized-steel wire.
- D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
- E. Adjustable Masonry-Veneer Anchors:
 - 1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.

2.5 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
 - 1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch thick.
 - 2. Copper: ASTM B370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. weight or 0.0216 inch thick or ASTM B370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. weight or 0.0162 inch thick.
 - 3. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
 - 4. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
 - 5. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
- B. Flexible Flashing: Use one of the following unless otherwise indicated:
 - 1. Copper-Laminated Flashing: 5-oz./sq. ft. copper sheet bonded between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Advanced Building Products Inc.
 - 2) Hohmann & Barnard, Inc.
 - 3) York Manufacturing, Inc.

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2. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.030 inch.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Carlisle Coatings & Waterproofing Inc.
 - 2) Heckmann Building Products, Inc.
 - 3) Hohmann & Barnard, Inc.
 - 4) W.R. Meadows, Inc.
 3. Butyl Rubber Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.030 inch.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) DuPont Safety & Construction.
 - 2) Protecto Wrap Company.
 - 3) Raven Industries, Inc.
 4. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) DuPont.
 - 2) Hohmann & Barnard, Inc.
 - 3) Mortar Net Solutions.
 5. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D4637/D4637M, 0.040 inch thick.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Carlisle Coatings & Waterproofing Inc.
 - 2) Firestone Specialty Products.
 - 3) Heckmann Building Products, Inc.
 - 4) Hohmann & Barnard, Inc.
- C. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."

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- D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.
- B. Weep/Vent Products: Use one of the following unless otherwise indicated:
1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Heckmann Building Products, Inc.
 - 2) Hohmann & Barnard, Inc.
 - 3) Wire-Bond.
 2. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Advanced Building Products Inc.
 - 2) CavClear/Archovations, Inc.
 - 3) Mortar Net Solutions.
 3. Aluminum Weep Hole/Vent: Units made from sheet aluminum, designed to fit into a head joint and consisting of a vertical channel, with louvers stamped in web and with a top flap to keep mortar out of the head joint; factory primed and painted before installation to comply with Section 099113 "Exterior Painting" in color selected by Architect.
 - a. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1) Hohmann & Barnard, Inc.
 4. Vinyl Weep Hole/Vent: Units made from flexible PVC, designed to fit into a head joint and consisting of a louvered vertical leg, flexible wings to seal against ends of masonry units, and a top flap to keep mortar out of the head joint; in color selected by Architect.

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- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hohmann & Barnard, Inc.
 - 2) Wire-Bond.
- C. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advanced Building Products Inc.
 - b. CavClear/Archovations, Inc.
 - c. Heckmann Building Products, Inc.
 - d. Hohmann & Barnard, Inc.
 - e. Mortar Net Solutions.
 2. Configuration: Provide one of the following:
 - a. Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches 7 inches deep that prevent clogging with mortar droppings.
 - b. Strips, not less than 3/4 inch thick and 10 inches high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.
 - c. Sheets or strips, full depth of cavity and installed to full height of cavity.

2.7 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Diedrich Technologies, Inc.; a Hohmann & Barnard company.
 - b. PROSOCO, Inc.

2.8 MORTAR MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
 2. Use portland cement-lime or masonry cement mortar unless otherwise indicated.

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3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Use Type N unless another type is indicated.
- D. Pigmented Mortar: Use colored cement product[or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products].
 1. Pigments shall not exceed 10 percent of portland cement by weight.
 2. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
 3. Application: Use pigmented mortar for exposed mortar joints.
- E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 1. Mix to match Architect's sample.
 2. Application: Use colored aggregate mortar for exposed mortar joints.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- B. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- C. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

3.2 TOLERANCES

- A. Dimensions and Locations of Elements:
 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.

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2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

3.3 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

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- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.5 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:
1. Fasten screw-attached anchors through sheathing to wall framing or to masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 2. Embed tie sections or connector sections and continuous wire in masonry joints.
 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 4. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.
 5. Space anchors as indicated, but not more than 16 inches o.c. vertically and 25 inches o.c. horizontally, with not less than one anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.
 6. Space anchors as indicated, but not more than 18 inches o.c. vertically and horizontally. Install additional anchors within 12 inches of openings and at intervals, not exceeding 24 inches, around perimeter.
- B. Provide not less than 1 inch of airspace between back of masonry veneer and face of sheathing.

3.6 FLASHING, WEEP HOLES, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 2. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.

4. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
- C. Install weep holes in veneers in head joints of first course of masonry immediately above embedded flashing.
 1. Use approved weep/vent products to form weep holes.
 2. Space weep holes 24 inches o.c. unless otherwise indicated.
- D. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- E. Install vents in head joints in exterior wythes at spacing indicated. Use approved weep/vent products to form vents.
 1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.7 REPAIRING, POINTING, AND CLEANING

- A. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- B. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.
 2. Protect adjacent stone and nonmasonry surfaces from contact with cleaner.
 3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.8 MASONRY WASTE DISPOSAL

- A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
 1. Do not dispose of masonry waste as fill within 18 inches of finished grade.
- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

MASONRY VENEER

END OF SECTION 042613

**RELEASE FOR
CONSTRUCTION
AS NOTED ON PLANS REVIEW
DEVELOPMENT SERVICES
LEE'S SUMMIT, MISSOURI**
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SECTION 047200 - CAST STONE MASONRY

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. Section Includes:

- 1. Cast stone.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

- 1. For cast stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

- 1. Include building elevations showing layout of units and locations of joints and anchors.

- C. Samples for Verification:

- 1. For each color and texture of cast stone required, 10 inches square in size.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project and is a plant certified by the Cast Stone Institute.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work and to minimize the need for on-site storage.

- B. Pack, handle, and ship cast stone units in suitable packs or pallets.

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1.6 PROJECT CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 CAST STONE MATERIALS

- A. General: Comply with ASTM C 1364 and the following:
- B. Portland Cement: ASTM C 150, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce cast stone color indicated.
- C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation and colors as needed to produce required cast stone textures and colors.
- D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation and colors as needed to produce required cast stone textures and colors.
- E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
- F. Admixtures: Use only admixtures specified or approved in writing by Architect.
 - 1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
 - 2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
 - 3. Air-Entraining Admixture: ASTM C 260. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
 - 4. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 5. Water-Reducing, Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 6. Water-Reducing, Accelerating Admixture: ASTM C 494/C 494M, Type E.
- G. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M, Grade 60. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of cast stone material.

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- H. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666, Type 304.

2.2 CAST STONE UNITS

- A. Basis of Design: Stone design and color to be selected from full range available. Wall capstone, reference construction documents for size and shape. Color to be selected from manufacturers standard color selections.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Advanced Cast Stone, Inc.
 2. Cast Stone Systems, Inc.
 3. Stonco..
- C. Provide cast stone units complying with ASTM C 1364 using either the vibrant dry tamp or wet-cast method.
1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.
- D. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
 2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
 3. Provide drips on projecting elements unless otherwise indicated.
- E. Fabrication Tolerances:
1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
 2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
 3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch , whichever is greater.
 4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.
- F. Cure units as follows:
1. Cure units in enclosed moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.

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2. Keep units damp and continue curing to comply with one of the following:

- a. No fewer than five days at mean daily temperature of 70 deg F or above.
- b. No fewer than six days at mean daily temperature of 60 deg F or above.
- c. No fewer than seven days at mean daily temperature of 50 deg F or above.
- d. No fewer than eight days at mean daily temperature of 45 deg F or above.

G. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

H. Colors and Textures: As selected by Architect from manufacturer's full range.

2.3 MORTAR MATERIALS

A. Provide mortar materials that comply with Section 042000 "Unit Masonry."

B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

C. Hydrated Lime: ASTM C 207, Type S.

D. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

E. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.

F. Water: Potable.

2.4 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.

B. Dowels: 1/2-inch-diameter, round bars, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.

C. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cast stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

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1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.5 MORTAR MIXES

- A. Comply with requirements in Section 042000 "Unit Masonry" for mortar mixes.
- B. Do not use admixtures including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
 2. Use portland cement-lime, masonry cement or mortar cement mortar unless otherwise indicated.
- C. Comply with ASTM C 270, Proportion Specification.
 1. For setting mortar, use Type S.
 2. For pointing mortar, use Type N.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SETTING CAST STONE IN MORTAR

- A. Set cast stone as indicated on Drawings. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.
 1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
 2. Coordinate installation of cast stone with installation of flashing specified in other Sections.
- B. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

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- C. Set units in full bed of mortar with full head joints unless otherwise indicated.
1. Set units with joints 1/4 to 3/8 inch wide unless otherwise indicated.
 2. Build anchors and ties into mortar joints as units are set.
 3. Fill dowel holes and anchor slots with mortar.
 4. Build concealed flashing into mortar joints as units are set.
- D. Rake out joints for pointing with mortar to depths of not less than 3/4 inch. Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.
- E. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch. Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.
- F. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- G. Provide sealant joints at copings and other horizontal surfaces, at expansion, control, and pressure-relieving joints, and at locations indicated.
1. Keep joints free of mortar and other rigid materials.
 2. Form joint of width indicated, but not less than 3/8 inch.

3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 ft, or 1/2 inch maximum.
- B. Variation from Level: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
- C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.

3.4 ADJUSTING AND CLEANING

- A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.
- B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean cast stone as work progresses.
1. Remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

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1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
3. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
4. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 047200

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SECTION 047300 - SIMULATED STONE VENEER

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. Section Includes:
 - 1. Simulated stone veneers for exterior applications adhered to wood framing and sheathing.
 - 2. Reinforcement, anchorages, mortar, flashing and accessories.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for sheathing joint and penetration treatment.

1.3 ACTION SUBMITTALS

- A. Product Data: For each variety of stone, stone accessory, and manufactured product.
- B. Samples:
 - 1. For each stone type indicated.
 - 2. For each color of mortar required.

1.4 FIELD CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1.5 WARRANTY

- A. Special Warranty: Warranty covers manufacturing defect of manufactured stone products. Warranty does not include labor for material replacement.
 - 1. Materials-Only Warranty Period: 40 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide Canyon Stone Inc. products or equal Manufactured Stone Veneer.
 - 1. Manufacturer: Eldorado Stone

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2. Style: Cliffstone
 3. Thickness: Varies from 1-inch to 2-inches
 4. Color: Banff Springs
- B. Building Paper: Water-vapor-permeable, asphalt-saturated kraft building paper that complies with ICC-ES AC38, Grade D.
- C. Expanded Metal Lath: 3.4 lb/sq. yd., self-furring, diamond-mesh lath complying with ASTM C 847. Fabricate from structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G60.
- D. Aluminum Sheet Flashing: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
1. ALSCO Coated Finish (Contractor's Option):
 - a. Dymalar 2000 Coating: AAMA 1482-86. Coating system specially formulated for use on aluminum trim coil.
 - b. Striated PVC
- E. Fasteners:
1. 1.75-inch galvanized roofing nails or staples
 2. Corrosion resistant, Number 8 self-tapping metal screws.
- F. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients designed for veneer applications and tuckpointing of manufactured stone.
1. Quikrete; Veneer Stone Mortar
- G. Water: Potable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate indicated to receive stone veneer prior to installation of wire lath, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone masonry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ADHERED STONE VENEER

- A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed. Install flashing over sheathing and behind weather-resistant sheathing paper by fastening through sheathing into framing.
1. Apply 2-layers of building paper horizontally with a 2-inch overlap and a 6-inch end lap; fastened to sheathing with galvanized staples or roofing nails.
- B. Install lath over weather-resistant sheathing paper by fastening through sheathing into framing to comply with ASTM C 1063.
- C. Install lath over unit masonry and concrete to comply with ASTM C 1063.
1. Install lath horizontally

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2. Overlap a minimum of 2-inches on the vertical seams, and at least 1-inch on the horizontal seams. The overlapping lath must begin or end on a framing member.
 3. Use fasteners that will penetrate the framing members a minimum of 1-inch. Fasteners to be placed every 6-inches vertically into framing members.
 4. Fold the lath tightly around corners and fasten to both faces of the corner.
 5. Do not install with a seam on a corner.
- D. Install scratch coat over metal lath 3/8 inch thick to comply with ASTM C 926.
- E. Thoroughly wet the scratch coat with water prior to applying the setting bed mortar and stone. Use sufficient setting mortar so a slight excess will be forced out the edges of stone units as they are set. Tap units into place, completely filling space between units and scratch coat.
- F. Start installation at corners and work toward the center of the wall. Alternate long and short returns on corner pieces.
- G. Apply the stone veneer.
1. Layout pattern prior to beginning work.
 2. Build in items plumb and level.
 3. The back of each stone should be entirely buttered with mortar mixture to a nominal 3/8-inch thickness.
 4. Bed anchors of metal doors and glazed frames in mortar joints. Fill frame voids solid with mortar.
 5. Firmly work the stone onto the scratch coat while pressing and moving back and forth to set the stone. Mortar should slightly ooze or squeeze out around the edges of the stone during this process.
 6. Apply grout in gaps between the stones to slightly above the desired finish depth. Let the grout dry until firm but not solid. Strike joints to achieve the desired look.
 7. If cuts are required, cut side should not be exposed on edges.
 8. Manufactured corner pieces should be utilized on all corners.

3.3 ADJUSTING AND CLEANING

- A. Cut and fit for chases, pipes, conduit, sleeves, and grounds.
1. Obtain approval from Architect prior to cutting or fitting any area not indicated on the drawings or where appearance or strength of masonry work may be impaired.
- B. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.
- C. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:
1. Remove excess mortar and smears with medium bristled brush or steel wool.
 2. Replace defective mortar. Match adjacent work.
 3. Clean soiled surfaces with non-acidic solution, acceptable to stone veneer manufacturer.
 4. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.

END OF SECTION 047300

METAL FABRICATIONS

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous steel framing and supports.
2. Shelf angles.
3. Metal bollards.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

METAL FABRICATIONS

- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Steel Tubing: As detailed on drawings
- D. Steel Pipe: Double Extra Strong as detailed on drawings

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required. Including, but not limited to, Gate facing Stainless Steel screws as shown on drawings.
- B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329.
- C. Post-Installed Anchors: [Torque-controlled expansion anchors] [or] [chemical anchors].
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy stainless-steel bolts, ASTM F593, and nuts, ASTM F594.
- D. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting."
- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- D. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

METAL FABRICATIONS

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
- C. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.
- E. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 8 inches from ends and corners of units and 24 inches o.c.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
- C. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.
 - 1. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches o.c.
- D. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

METAL FABRICATIONS

2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.
- D. Prime shelf angles located in exterior walls with [zinc-rich primer.] [primer specified in Section 099600 "High-Performance Coatings."]
- E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
- C. Prime exterior miscellaneous steel trim with zinc-rich primer.

2.9 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 80 steel pipe.
- B. Cast bollards into concrete piers.
- C. Prime bollards with zinc-rich primer.

2.10 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

2.11 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
- B. Hot-dip Galvanize loose steel lintels located in exterior walls.

METAL FABRICATIONS

2.12 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.13 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.

2.14 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
- B. Shop Priming: Iron and steel items noted to be painted, apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.

METAL FABRICATIONS

- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING METAL BOLLARDS

- A. Anchor bollards in place with concrete footings. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- B. Fill bollards solidly with concrete, mounding top surface to shed water.

3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 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.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 055000

ROUGH CARPENTRY

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Shear wall panels.
4. Rooftop equipment bases and support curbs.
5. Wood blocking, cants, and nailers.
6. Wood furring and grounds.
7. Wood sleepers.
8. Plywood backing panels.

1.2 ACTION SUBMITTALS

- ###### A. Product Data:
- For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

- ###### A. Material Certificates:
- For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- ###### B. Evaluation Reports:
- For the following, from ICC-ES:
1. Wood-preservative-treated wood.
 2. Fire-retardant-treated wood.
 3. Engineered wood products.
 4. Shear panels.
 5. Power-driven fasteners.
 6. Post-installed anchors.
 7. Metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- ###### A. Lumber:
- DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWP U1; Use Category UC2[for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground].

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches above the ground in crawlspace or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction,

and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
 - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings, and the following:
 - 1. Framing for raised platforms.
 - 2. Framing for stages.
 - 3. Concealed blocking.
 - 4. Framing for non-load-bearing partitions.
 - 5. Framing for non-load-bearing exterior walls.
 - 6. Roof construction.
 - 7. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing Interior Partitions: As Defined on Construction Documents.
- B. Framing Other Than Non-Load-Bearing Partitions: As Defined on Construction Documents.
- C. Framing Other Than Non-Load-Bearing Partitions: As Defined on Construction Documents.
- D. Exposed Framing: Hand-select material for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
 - 1. Species and Grade: As indicated above for load-bearing construction of same type.

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2.5 ENGINEERED WOOD PRODUCTS

- A. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.

2.6 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Cants.
 - 5. Furring.
 - 6. Grounds.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

2.7 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.8 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

2.9 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

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- C. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
- D. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- D. Install shear wall panels to comply with manufacturer's written instructions.
- E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Do not splice structural members between supports unless otherwise indicated.
- G. Comply with AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 - 3. ICC-ES evaluation report for fastener.

3.2 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered

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borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SHEATHING

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wall sheathing – ZIP System
 - 2. Roof sheathing.
 - 3. Parapet sheathing.
 - 4. Sheathing joint and penetration treatment.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 WALL SHEATHING

- A. Oriented-Strand-Board Sheathing: Basis-of-Design Product: Exposure 1, Structural I sheathing. Provide Huber Engineered Woods LLC; Sheathing. (Zip System)
 - 1. Span Rating and Performance Category: Not less than 32/16, 1/2 Performance Category.
 - 2. Edge Profile: Square edge
 - 3. DOC PS 2 sheathing, made with binder containing no added urea formaldehyde, with visible grade stamp and field identification.
 - 4. Code Compliance Standard: ICC-ES ESR-1785 for basis of design product, or ICC-ESR of comparable product acceptable to Architect.
 - 5. Panel Exposure: Warranted by manufacturer to resist weather exposure for 500 days.
 - 6. Fastener Marking: On top panel surface with pre-spaced fastening symbols for 16-inches and 24-inches on center spacings
- B. Paper-Surfaced Gypsum Sheathing: ASTM C1396/C1396M, gypsum sheathing; with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges.
 - 1. Type and Thickness: Regular, 5/8 inch thick.
- C. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M.
 - 1. Type and Thickness: Regular, 1/2 inch thick.

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2.3 ROOF SHEATHING

- A. Plywood Sheathing: As Defined on Construction Documents.
- B. Oriented-Strand-Board Sheathing: DOC PS 2 sheathing.

2.4 PARAPET SHEATHING

- A. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M, , with fiberglass mat laminated to both sides and with manufacturer's standard edges.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Georgia-Pacific Gypsum: "DensGlass Sheathing" or a comparable product by one of the following:
 - 2. Type and Thickness: Regular, ½-inch thick.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For roof, parapet, and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
 - 2. For roof parapet and wall sheathing, provide fasteners with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117.

2.6 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
 - 1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.
- B. Self-Adhering Seam and Flashing Tape: Pressure-sensitive, self-adhering, cold-applied, seam tape consisting of polyolefin film with acrylic adhesive, meeting ICC AC148.
 - 1. Basis-of-Design Product: Provide Huber Engineered Woods; ZIP System Tape.
 - 2. Thickness: 0.012 inch

2.7 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with ASTM D3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

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PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
- D. Coordinate wall, parapet, and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
 - 1. Roof Sheathing:
 - a. Nail to wood framing.
 - b. Screw to cold-formed metal framing.
 - c. Space panels 1/8 inch apart at edges and ends.
 - 2. Wall Sheathing
 - a. Examine framing spacing and alignment to determine if work is ready to receive sheathing. Proceed with sheathing work once conditions meet requirements.
 - b. Install wall sheathing panels in accordance with manufacturer's written instructions, requirements of applicable Evaluation Reports, and requirements of authorities having jurisdiction.
 - c. Air and Moisture Barrier: Coordinate sheathing installation with flashing and joint sealant installation and with adjacent building air and moisture barrier components to provide complete, continuous air- and moisture- barrier
 - d. Do not bridge expansion joints; allow joint spacing equal to spacing of structural supports.
 - e. Install panels with laminated facer to exterior. Stagger end joints of adjacent panel runs.
 - f. Continuously support panel ends.
 - g. Continuously support panel edges without tongue-and-groove edge profile where indicated.

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- h. Attach sheathing panels securely to substrate with manufacturer-approved fasteners in compliance with the following:
 - 1) ICC-ES ESR-1539 or ICC-NES NER-272 for power-driven fasteners.
 - 2) IBC: Table 2304.9.1 Fastening Schedule.
- i. Wood Framing: Nail; penetrate wood framing members at least 1 inch.
 - 1) Space panels 1/8 inch apart at square edges and ends.
 - 2) Install fasteners 3/8 inch to 1/2 inch from panel edges.
 - 3) Space fasteners 6 inches on centers on supported panel edges and 12 inches on centers at intermediate support locations.
- j. Comply with applicable portions of APA Form No. E30.
- k. Optimize joint arrangements resulting in minimum number of joints. Cut panels cleanly at penetrations.
- l. Apply seam tape at all panel seams, penetrations, and facer defects or cracks to form continuous weathertight surface. Apply tape according to manufacturer's written instructions and requirements of ICC-ES applicable to tape application.

3.3 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to wood framing with nails.
 - 2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 3. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Seal sheathing joints according to sheathing manufacturer's written instructions.
 - 1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 - 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 061600

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SECTION 061753 - SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood roof trusses.
2. Wood girder trusses.

1.2 ALLOWANCES

A. Not used.

1.3 ACTION SUBMITTALS

A. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.

B. Shop Drawings: Show fabrication and installation details for trusses.

1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
2. Indicate sizes, stress grades, and species of lumber.
3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
6. Show splice details and bearing details.

C. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss-fabricating firm.

B. Evaluation Reports: For the following, from ICC-ES:

1. Metal-plate connectors.

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2. Metal truss accessories.

1.5 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
 1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program, complies with quality-control procedures in TPI 1, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction and is certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal-plate-connected wood trusses.
- B. Structural Performance: Metal-plate-connected wood trusses shall be capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1.
- C. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.
- D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (ALSC) Board of Review. Provide lumber

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graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- B. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 061000 "Rough Carpentry."

2.3 METAL CONNECTOR PLATES

- A. General: Fabricate connector plates to comply with TPI 1.
- B. Hot-Dip Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
 2. Where trusses are exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Nails, Brads, and Staples: ASTM F1667.

2.5 METAL FRAMING ANCHORS AND ACCESSORIES

- A. Allowable design loads, as published by manufacturer, shall comply with or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.

2.6 FABRICATION

- A. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

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- B. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.
- F. Securely connect each truss ply required for forming built-up girder trusses.
- G. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 - 1. Install bracing to comply with Section 061000 "Rough Carpentry."
 - 2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- H. Install wood trusses within installation tolerances in TPI 1.
- I. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.
- J. Replace wood trusses that are damaged or do not comply with requirements.

END OF SECTION 061753

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THERMAL INSULATION

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass-fiber blanket.
2. Glass-fiber board.
3. Mineral Wool Blanket Insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Research reports.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET

A. Glass-Fiber Blanket, Unfaced: ASTM C665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Owens Corning.

B. Glass-Fiber Blanket, Kraft Faced: ASTM C665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.

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- b. Johns Manville; a Berkshire Hathaway company.
- c. Owens Corning.

2.2 ACCESSORIES

A. Insulation for Miscellaneous Voids:

- 1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
- 2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Insulation Anchors, Spindles, and Standoffs: As recommended by manufacturer.

C. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

Retain "Eave Ventilation Troughs" Paragraph below if required for vented eaves in attics to receive blanket insulation.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.2 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

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1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 4. For wood-framed construction, install blankets according to ASTM C1320 and as follows:
 - a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

END OF SECTION 072100

WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM
(EIFS)

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SECTION 072419 - WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM
(EIFS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. EIFS-clad drainage-wall assemblies that are field applied over substrate.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each EIFS component, trim, and accessory.
- B. Shop Drawings:
1. Include details for EIFS buildouts.
- C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Manufacturer certificates.
- B. Product certificates.
- C. Product test reports.
- D. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An installer who is certified in writing by AWCI International as qualified to install Class PB EIFS using trained workers.

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1.7 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of EIFS-clad drainage-wall assemblies that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dryvit Systems, Inc.
2. Parex USA, Inc.
3. Sto Corp.

2.2 PERFORMANCE REQUIREMENTS

- A. EIFS Performance: Comply with ASTM E2568 and with the following:
1. Weathertightness: Resistant to uncontrolled water penetration from exterior, with a means to drain water entering EIFS to the exterior.
 2. Impact Performance: ASTM E2568, Standard impact resistance.
 3. Drainage Efficiency: 90 percent average minimum when tested according to ASTM E2273.

2.3 EIFS MATERIALS

- A. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt, and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.
- B. Drainage Mat: Three-dimensional, nonwoven, entangled filament, nylon or plastic mat designed to drain incidental moisture by gravity; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer, with manufacturer's standard corrosion-resistant mechanical fasteners suitable for intended substrate EIFS manufacturer's standard formulation designed for indicated use; specifically formulated to be applied to back side of insulation in a manner that creates open vertical channels designed to serve as an integral part of the water-drainage system of the EIFS-clad drainage-wall assembly; compatible with substrate.
- C. Molded, (Expanded) Rigid Cellular Polystyrene Board Insulation: Comply with ASTM E2430/E2430M.
1. Foam Buildouts: Provide with profiles and dimensions indicated on Drawings.

WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

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- D. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. according to ASTM E2098/E2098M.
- E. Base Coat: EIFS manufacturer's standard mixture.
- F. Mechanical Fasteners: EIFS manufacturer's standard corrosion-resistant fasteners, consisting of thermal cap, standard washer and shaft attachments, and fastener indicated below; designed to resist Project's design loads; capable of pulling fastener head below surface of insulation board; and complying with the following:
 - 1. For attachment to wood framing members and plywood sheathing, provide steel drill screws complying with ASTM C1002, Type W.
 - 2. For attachment to masonry and concrete substrates, provide sheathing dowel in form of a plastic wing-tipped fastener with thermal cap, sized to fit insulation thickness indicated and to penetrate substrate to depth required to secure anchorage.
 - 3. For attachment to ZIP System, provide manufacturer's standard fasteners suitable for substrate.
- G. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
- H. Finish Coat: EIFS manufacturer's standard acrylic-based coating with enhanced mildew resistance.
 - 1. Colors: As noted in Construction Documents
 - 2. Texture: As noted in Construction Documents
- I. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D1784, manufacturer's standard cell class for use intended, and ASTM C1063.

PART 3 - EXECUTION

3.1 EIFS INSTALLATION

- A. Comply with ASTM C1397, ASTM E2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.
- B. Water-Resistive Barrier Coating: Not Used – Part of ZIP System.
- C. Flexible-Membrane Flashing: Install over water-resistive barrier coating, applied and lapped to shed water; seal at openings, penetrations, and terminations. Prime substrates with flashing primer if required and install flashing.
- D. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, and elsewhere as indicated. Coordinate with installation of insulation.

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- E. Board Insulation: Mechanically fasten insulation to substrate in compliance with ASTM C1397.
1. Mechanically attach insulation to substrate. Install top surface of fastener heads flush with plane of insulation. Install fasteners into or through substrates with the following minimum penetration:
 - a. Steel Framing: 5/16 inch (8 mm).
 - b. Wood Framing: 1 inch (25 mm).
 - c. Concrete and Masonry: 1 inch (25 mm).
 2. Apply insulation over substrates in courses with long edges of boards oriented horizontally.
 3. Begin first course of insulation from a level base line and work upward.
 4. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints, so no piece of insulation is less than 12 inches (300 mm) wide or 6 inches (150 mm) high. Offset joints not less than 6 inches (150 mm) from corners of window and door openings[**and not less than 4 inches (100 mm) from aesthetic reveals**].
 - a. Mechanical Attachment: Offset joints of insulation from horizontal joints in sheathing.
 5. Apply channeled insulation, aligned vertically.
 6. Interlock ends at internal and external corners.
 7. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch (1.6 mm) occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
 8. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
 9. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/32 inch (0.8 mm) from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch (1.6 mm). Prevent airborne dispersal and immediately collect insulation raspings or sandings.
 10. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch (19 mm).
 11. Install foam buildouts and attach to structural substrate by **mechanical fastening**.
 12. Interrupt insulation for expansion joints where indicated.
 13. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
 14. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.
 15. Before installing insulation and before applying field-applied reinforcing mesh, fully wrap board edges. Cover edges of board and extend encapsulating mesh

WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM
(EIFS)

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not less than 2-1/2 inches (64 mm) over front and back face unless otherwise indicated on Drawings.

16. Treat exposed edges of insulation as follows:
 - a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
 - b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
 - c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.
 17. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and water-resistive barrier coating.
- F. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer.
- G. Water-Resistant Base Coat: Apply full-thickness coverage to exposed insulation and to exposed surfaces of foam build-outs and to other surfaces indicated on Drawings.
- H. Base Coat: Apply full coverage to exposed insulation and foam build-outs with not less than 1/16-inch dry-coat thickness.
- I. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C1397. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.
- J. Foam Buildouts: Fully embed reinforcing mesh in base coat.
- K. Finish Coat: Apply full-thickness coverage over dry primed base coat, maintaining a wet edge at all times for uniform appearance, to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.
- L. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.

END OF SECTION 072419

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VAPOR RETARDERS

SECTION 072600 - VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polyethylene vapor retarders.
2. Reinforced-polyethylene vapor retarders.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for under-slab vapor retarders.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

PART 2 - PRODUCTS

2.1 POLYETHYLENE VAPOR RETARDERS

- ###### A. Polyethylene Vapor Retarders: ASTM D4397, 6-mil- thick sheet, with maximum permeance rating of 0.1 perm.

2.2 REINFORCED-POLYETHYLENE VAPOR RETARDERS

- ###### A. Reinforced-Polyethylene Vapor Retarders: Sheet with outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 20 lb/1000 sq. ft., with maximum permeance rating of 0.1 perm.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ISI Building Products.
 - b. Raven Industries, Inc.
 - c. Reef Industries, Inc.

VAPOR RETARDERS

PART 3 - EXECUTION

3.1 INSTALLATION OF VAPOR RETARDERS ON FRAMING

- A. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.
- C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

END OF SECTION 072600

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THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

SECTION 075423 - THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanically fastened, thermoplastic polyolefin (TPO) roofing system.
2. Roof insulation.
3. Cover board.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include roof plans, elevations, sections, details, and attachments to other work.

C. Samples: For the following products:

1. Roof membrane and flashings, of color required.

D. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.4 INFORMATIONAL SUBMITTALS

A. Research / Evaluation Reports: For components of roofing system, from ICC-ES.

B. Sample warranties: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data: For roofing system to include in maintenance manuals.

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1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:

- 1. Basis of Design: Firestone Building Products

- 2. Approved Equal:

- a. Carlisle SynTec Incorporated.
 - b. Mule-Hide Products Co., Inc.

- B. Source Limitations: Obtain components including roof insulation and fasteners for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer

2.2 PERFORMANCE REQUIREMENTS

- A. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.

- B. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

- C. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures:

- 1. Fire/Windstorm Classification: Class 1A-90.

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2.3 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

- A. TPO Sheet: ASTM D6878/D6878M, internally fabric- or scrim-reinforced, fabric-backed TPO sheet.
 - 1. Thickness: 45 mils, nominal.
 - 2. Exposed Face Color: White

2.4 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
 - 1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, of same color as TPO sheet.
- C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
- D. Bonding Adhesive: Manufacturer's standard.
- E. Slip Sheet: Manufacturer's standard, of thickness required for application.
- F. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.
- H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.5 ROOF INSULATION

- A. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Basis of Design: Firestone Building Products
 - b. Approved Equal:
 - 1) Carlisle SynTec Incorporated.
 - 2) GAF Materials Corporation.
- B. Tapered Insulation: Provide factory-tapered insulation boards.

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1. Material: Match roof insulation.
2. Minimum Thickness: 1/4 inch.
3. Slope at Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

2.6 INSULATION ACCESSORIES

- A. Fasteners: Factory-coated steel fasteners with metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- B. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer.
- C. Cover Board: ASTM C1289 Type II, Class 4, Grade 2, 1/2-inch-thick polyisocyanurate, with a minimum compressive strength of 120 psi.
 1. Firestone ISOGARD HD Cover Board

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

3.2 PREPARATION

- A. Perform fastener-pullout tests according to roof system manufacturer's written instructions.
 1. Submit test result within 24 hours after performing tests.
 - a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.3 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.

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3.4 INSULATION INSTALLATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and roof insulation manufacturer's written instructions for installing roof insulation.
- C. Installation:
 - 1. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
 - a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
 - b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
 - c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
 - e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
 - 1) Trim insulation so that water flow is unrestricted.
 - f. Fill gaps exceeding 1/4 inch with insulation.
 - g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

3.5 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
 - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 - 3. Cut and fit cover board tight to nailers, projections, and penetrations.

3.6 MECHANICALLY FASTENED ROOFING INSTALLATION

- A. Mechanically fasten roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll roof membrane and allow to relax before installing.
- C. Start installation of roofing in presence of roofing system manufacturer's technical personnel .

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- D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- E. Mechanically fasten or adhere roof membrane securely at terminations, penetrations, and perimeter of roofing.
- F. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- G. In-Seam Attachment: Secure one edge of TPO sheet using fastening plates or metal battens centered within seam, and mechanically fasten TPO sheet to roof deck.
- H. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and flashing sheet.
 - 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.
- I. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.7 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.8 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

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- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075423

SHEET METAL FLASHING AND TRIM

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SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formed sheet metal fabrications.

1.2 ACTION SUBMITTALS

A. Product Data: For each of the following

1. Underlayment materials.
2. Elastomeric sealant.
3. Butyl sealant.
4. Epoxy seam sealer.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.

C. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.4 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Delta units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
 1. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 2. Color: Match Architect's sample.
 3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.
- C. Lead Sheet: ASTM B749 lead sheet.

2.3 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- B. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F; and complying with physical requirements of ASTM D226/D226M for Type I and Type II felts.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas EPS; a Division of Atlas Roofing Corporation.
 - b. Intertape Polymer Group.
 - c. Kirsch Building Products, LLC.
- C. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle Residential; a division of Carlisle Construction Materials.
 - b. Henry Company.
 - c. Owens Corning.
 - 2. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F or lower.
- D. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC

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sealing washers under heads of exposed fasteners bearing on weather side of metal.

- b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- G. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

2.5 FABRICATION, GENERAL

- A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
- 1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
 - 4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances:
- 1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings

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- and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.
- G. Seams:
1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
 3. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

2.6 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch-high, end dams. Fabricate from the following materials:
1. Stainless Steel: **[0.016 inch]** thick.
- B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:
1. Aluminum: 0.032 inch thick.

PART 3 - EXECUTION

3.1 INSTALLATION OF UNDERLAYMENT

- A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim.
 - 1. Install in shingle fashion to shed water.
 - 2. Lap joints not less than 2 inches.
- B. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, in accordance with manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.
 - 1. Lap horizontal joints not less than 4 inches.
 - 2. Lap end joints not less than 12 inches.
- C. Self-Adhering, High-Temperature Sheet Underlayment:
 - 1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
 - 2. Prime substrate if recommended by underlayment manufacturer.
 - 3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
 - 4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
 - 5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
 - 6. Roll laps and edges with roller.
 - 7. Cover underlayment within 14 days.
- D. Install slip sheet, wrinkle free, directly on substrate before installing sheet metal flashing and trim.
 - 1. Install in shingle fashion to shed water.
 - 2. Lap joints not less than 4 inches.

3.2 INSTALLATION, GENERAL

- A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
 - 1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
 - 3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.

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4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
 5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
 6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
 8. Do not field cut sheet metal flashing and trim by torch.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of **[uncoated-aluminum] [and] [stainless steel]** sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
1. Space movement joints at maximum of **[10 feet] <Insert dimension>** with no joints within 24 inches of corner or intersection.
 2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 3. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws <Insert size requirement>.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated.
 - a. Embed hooked flanges of joint members not less than 1 inch into sealant.
 - b. Form joints to completely conceal sealant.
 - c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
 - d. Adjust setting proportionately for installation at higher ambient temperatures.
 - 1) Do not install sealant-type joints at temperatures below 40 deg F.

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2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

- G. Rivets: Rivet joints where necessary for strength.

3.3 INSTALLATION OF WALL FLASHINGS

- A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.4 INSTALLATION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.5 CLEANING

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.

3.6 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 076200

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ROOF SPECIALTIES

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Copings.
 - 2. Roof-edge drainage systems.
 - 3. Reglets and counterflashings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For roof specialties.
 - 1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
- C. Samples: For each type of roof specialty and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For tests performed by a qualified testing agency.
- B. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class.

1.6 WARRANTY

- A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 075423 "Thermoplastic-polyolefin (TPO) Roofing."

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- B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. FM Approvals' Listing: Manufacture and install copings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.
1. Design Pressure: As indicated on Drawings.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COPINGS

- A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Metal-Era, Inc.
 - b. Berridge Manufacturing Company.
 - c. Hickman Company, W. P.
 2. Formed Aluminum Sheet Coping Caps: Aluminum sheet, 0.050 inch thick.

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- a. Surface: Smooth, flat finish.
 - b. Finish: Three-coat fluoropolymer.
 - c. Color: Match Architect's sample - Benjamin Moore OC-45 "Swiss Coffee".
3. Corners: Factory mitered and continuously welded.
 4. Coping-Cap Attachment Method: Snap-on or face leg hooked to continuous cleat with back leg fastener exposed, fabricated from coping-cap material.
 - a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches wide, with integral cleats.
 - b. Face-Leg Cleats: Concealed, continuous stainless steel.

2.3 ROOF-EDGE DRAINAGE SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. ATAS International, Inc.
 2. Hickman Company, W. P.
 3. Metal-Era, Inc.
- B. Downspouts: Plain rectangular complete with mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
 1. Formed Aluminum: 0.040 inch thick.
- C. Parapet Scuppers: Manufactured with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof.
 1. Stainless Steel: 0.019 inch thick.
- D. Aluminum Finish: Two-coat fluoropolymer.
 1. Color: Black.

2.4 REGLETS AND COUNTERFLASHINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Berridge Manufacturing Company.
 2. Hickman Company, W. P.
 3. Metal-Era, Inc.
- B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:

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1. Formed Aluminum: 0.050 inch thick.
 2. Corners: Factory mitered and continuously welded.
 3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
- C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:
1. Formed Aluminum: 0.032 inch thick.
- D. Accessories:
1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
 2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
- E. Aluminum Finish: Two-coat fluoropolymer.
1. Color: Match Architect's sample.

2.5 MATERIALS

- A. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

2.6 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle Coatings & Waterproofing Inc.
 - b. Henry Company.
 - c. Owens Corning.
 2. Thermal Stability: ASTM D1970/D1970M; stable after testing at 240 deg F.
 3. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F.

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- B. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- C. Slip Sheet: Rosin-sized building paper, 3-lb/100 sq. ft. minimum.

2.7 MISCELLANEOUS MATERIALS

- A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:
 - 1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
 - 2. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
 - 3. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
 - 4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 - 5. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.
- B. Elastomeric Sealant: ASTM C920, elastomeric **[polyurethane]** **[silicone]** polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.
- C. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- E. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.
- F. Solder for Copper: ASTM B32, lead-free solder.

2.8 FINISHES

- A. Coil-Coated Aluminum Sheet Finishes:
 - 1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
 - b. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
1. Apply continuously under copings and reglets and counterflashings.
 2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.
- B. Felt Underlayment: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.
- C. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.2 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
 2. Provide uniform, neat seams with minimum exposure of solder and sealant.
 3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
 4. Torch cutting of roof specialties is not permitted.
 5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
1. Coat concealed side of uncoated aluminum and stainless-steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

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1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
 2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.3 COPING INSTALLATION

- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.
1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements.
 2. Interlock face-leg drip edge into continuous cleat anchored to substrate at manufacturer's required spacing that meets performance requirements. Anchor back leg of coping with screw fasteners and elastomeric washers at manufacturer's required spacing that meets performance requirements.

3.4 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION

- A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.
- B. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.
1. Provide elbows at base of downspouts at grade to direct water away from building.

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2. Connect downspouts to underground drainage system indicated.

- C. Parapet Scuppers: Install scuppers through parapet where indicated. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

3.5 REGLET AND COUNTERFLASHING INSTALLATION

- A. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.
- B. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.6 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed.

END OF SECTION 077100

JOINT SEALANTS

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.

1.2 QUALITY ASSURANCE

- ###### A. Testing Agency Qualifications:
- Qualified according to ASTM C1021 to conduct the testing indicated.

1.3 WARRANTY

- ###### A. Special Installer's Warranty:
- Installer agrees to repair or replace joint sealants that do not perform within specified warranty period.
1. Warranty Period: **Two** years from date of Substantial Completion.
- ###### B. Special Manufacturer's Warranty:
- Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not perform within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- ###### A. Available Products:
- Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.
- ###### B. Products Selection:
- Select proposed sealant systems appropriate for joints to be sealed. Submit in accordance with product substitution procedures.

JOINT SEALANTS

2.2 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As indicated by manufacturer's designations.

2.3 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dow Corning Corporation; Dow Corning 786
 - b. GE Construction Sealants; Sanitary 1700
 - c. Pecora Corporation: Pecora 898 Sanitary Silicone Sealant.

2.4 URETHANE JOINT SEALANTS

- A. Urethane, M, NS, 50, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 50, Use NT.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Pecora Corporation. Dynatrol II.
 - b. Polymeric Systems, Inc.; PSI-270
 - c. Sika Corp., Sikaflex – 2c NS
 - d. Tremco Incorporated; Dymeric 240

2.5 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems; Sonolac.
 - b. Bostik, Inc.; Chem-Calk 600.
 - c. Pecora Corporation; AC-20+.
 - d. Schnee-Morehead, Inc.; SM 8200.
 - e. Tremco Incorporated; Tremflex 834.

JOINT SEALANTS

2.6 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing..

2.7 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove laitance and form-release agents from concrete.
 - 2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces.

JOINT SEALANTS

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with ASTM C1193 and joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 1. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200

SECTION 081113 – HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Standard hollow-steel doors.
 - 2. Standard hollow-steel frames.
- B. Related Sections include the following:
 - 1. Division 8 Sections for door hardware for standard steel doors.
 - 2. Division 9 painting Sections for field painting standard steel doors and frames.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.

1.4 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, and finishes for each type of steel door and frame specified.
- B. Shop Drawings: In addition to requirements below, provide a schedule of standard steel doors and frames using same reference numbers for details and openings as those on Drawings:
 - 1. Elevations of each door design.
 - 2. Details of doors, including vertical and horizontal edge details.
 - 3. Frame details for each frame type, including dimensioned profiles.
 - 4. Details and locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, accessories, joints, and connections.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

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1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
 - 1. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.
 - 1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 COORDINATION

- A. Coordinate installation of anchorages for standard steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amweld Building Products, LLC.
 - 2. Benchmark Doors; a division of General Products Co., Inc.
 - 3. CURRIES Company; an ASSA ABLOY Group Company.
 - 4. Republic Builders Products Company.
 - 5. Steelcraft; an Ingersoll-Rand Company.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

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- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum **A40** zinc-iron-alloy (galvannealed) coating designation.
- D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized.
- E. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.
- F. Grout: Comply with ASTM C 476, with a slump of **4 inches** for standard steel door frames built into concrete or masonry, as measured according to ASTM C 143/C 143M.

2.3 STANDARD STEEL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.
 - a. Fire Door Core: As required to provide fire-protection ratings indicated.
 - b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than **4.0 deg F x h x sq. ft./Btu** when tested according to ASTM C 1363.
 - 1) Locations: Exterior doors.
 - 3. Vertical Edges for Single-Acting Doors: Square edge.
 - 4. Top and Bottom Edges: Closed with flush or inverted **0.042-inch-** thick end closures or channels of same material as face sheets.
 - 5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
 - 1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush).
- C. Hardware Reinforcement: Fabricate reinforcement plates from same material as door face sheets to comply with the following minimum sizes:
 - 1. Hinges: Minimum **0.123 inch** thick by **1-1/2 inches** wide by **6 inches** longer than hinge, secured by not less than 6 spot welds.
 - 2. All Other Surface-Mounted Hardware: Minimum **0.067 inch** thick.
- D. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD STEEL FRAMES

- A. General: Comply with ANSI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
 - 1. Fabricate frames with mitered or coped and welded face corners and seamless face joints.
 - 2. Frames for Level 3 Steel Doors: 0.053-inch- thick steel sheet.
- C. Hardware Reinforcement: Fabricate reinforcement plates from same material as frames to comply with the following minimum sizes:
 - 1. Hinges: Minimum 0.123 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
 - 2. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick.
- D. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.
- E. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
- F. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.5 FABRICATION

- A. General: Fabricate standard steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Standard Steel Doors:
 - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- C. Standard Steel Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - 2. Jamb Anchors:
 - a. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 - b. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).

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- c. Postinstalled Expansion Anchor: Minimum **3/8-inch- (9.5-mm-)** diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

- D. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."
1. Reinforce doors and frames to receive nontemplated mortised and surface-mounted door hardware.
 2. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for door and frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

2.6 STEEL FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Finish standard steel door and frames after assembly.
- B. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than **0.7 mils**.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of standard steel doors and frames.
1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory.
- B. Prior to installation and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
1. Squareness: Plus or minus **1/16 inch**, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

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2. Alignment: Plus or minus **1/16 inch**, measured at jambs on a horizontal line parallel to plane of wall.
 3. Twist: Plus or minus **1/16 inch**, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 4. Plumbness: Plus or minus **1/16 inch**, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Provide doors and frames of sizes, thicknesses, and designs indicated. Install standard steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Standard Steel Frames: Install standard steel frames for doors and other openings, of size and profile indicated. Comply with SDI 105.
1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Install door silencers in frames before grouting.
 - c. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - d. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 2. Installation Tolerances: Adjust standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus **1/16 inch**, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus **1/16 inch**, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus **1/16 inch**, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus **1/16 inch**, measured at jambs at floor.
- C. Standard Steel Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: **1/8 inch** plus or minus **1/16 inch**.
 - b. Between Edges of Pairs of Doors: **1/8 inch** plus or minus **1/16 inch**.
 - c. Between Bottom of Door and Top of Threshold: Maximum **3/8 inch**.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum **3/4 inch**.
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

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3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including standard steel doors or frames that are warped, bowed, or otherwise unacceptable.
- B. Clean grout and other bonding material off standard steel doors and frames immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
- D. Galvannealed Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

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SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

Section Includes:

1. Storefront framing.
2. Manual-swing entrance doors.

1.2 ACTION SUBMITTALS

Product Data: For each type of product.

Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

Samples: For each type of exposed finish required.

Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.

1.3 INFORMATIONAL SUBMITTALS

Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.

Product test reports.

Source quality-control reports.

Sample warranties.

1.4 CLOSEOUT SUBMITTALS

Maintenance data.

1.5 QUALITY ASSURANCE

Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

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1.6 WARRANTY

Special Warranty: Installer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.

2. Failure also includes the following:

- a. Thermal stresses transferring to building structure.
- b. Glass breakage.
- c. Noise or vibration created by wind and thermal and structural movements.
- d. Loosening or weakening of fasteners, attachments, and other components.
- e. Failure of operating units.

Structural Loads:

3. Wind Loads: As indicated on Drawings.

Air Infiltration: Test according to ASTM E283 for infiltration as follows:

4. Fixed Framing and Glass Area:

- a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

5. Entrance Doors:

- a. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

Water Penetration under Static Pressure: Test according to ASTM E331 as follows:

6. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested according to a minimum static-air-

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pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

Energy Performance: Certify and label energy performance according to NFRC as follows:

7. Thermal Transmittance (U-factor): Fixed glazing and framing areas as a system shall have U-factor of not more than 0.41 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
8. Solar Heat Gain Coefficient (SHGC): Fixed glazing and framing areas as a system shall have SHGC of no greater than 0.26 as determined according to NFRC 200.
9. Condensation Resistance: Fixed glazing and framing areas as a system shall have an NFRC-certified condensation resistance rating of no less than 15 as determined according to NFRC 500.

Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

10. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 STOREFRONT SYSTEMS

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. EFCO Corporation.
2. Kawneer North America, an Arconic company.
3. Manko Window Systems, Inc.

Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

4. Exterior Framing Construction: Thermally broken.
5. Glazing System: Retained mechanically with gaskets on four sides.
6. Finish: **BLACK ANODIZED**
7. Fabrication Method: Field-fabricated stick system.
8. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
9. Steel Reinforcement: As required by manufacturer.

Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.3 ENTRANCE DOOR SYSTEMS

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. EFCO Corporation.
2. Kawneer North America, an Arconic company.

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3. Manko Window Systems, Inc.

Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

4. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
5. Door Design: Medium stile; 3-1/2-inch nominal width.
6. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.
7. Manko Window Systems, Inc. 2450CG, 4 1/2" Thermally Broken Storefront Window System.
 - a. Operable Units: Provide a minimum 1/16-inch (1.6-mm) clearance between framing members and operable units.

2.4 ENTRANCE DOOR HARDWARE

General: Provide entrance door hardware and entrance door hardware sets indicated to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
2. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.
 - b. Accessible Interior Doors: Not more than 5 lbf to fully open door.

Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:

3. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
4. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

Butt Hinges: BHMA A156.1, Grade 1, radius corner.

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5. Nonremovable Pins: Provide setscrew in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
6. Exterior Hinges: Stainless steel, with stainless-steel pin.
7. Quantities:

- a. For doors up to 87 inches high, provide three hinges per leaf.

Cylinders: BHMA A156.5, Grade 1.

8. Keying: Master key system. Permanently inscribe each key with a visual key control number and include notation "DO NOT DUPLICATE".

Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.

Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

Weather Stripping: Manufacturer's standard replaceable components.

9. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.

Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

2.5 GLAZING

Glazing: Comply with Section 088000 "Glazing."

Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

Glazing Sealants: As recommended by manufacturer.

2.6 MATERIALS

Sheet and Plate: ASTM B209.

Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

Extruded Structural Pipe and Tubes: ASTM B429/B429M.

Structural Profiles: ASTM B308/B308M.

Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.
4. Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

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2.7 FABRICATION

Form or extrude aluminum shapes before finishing.

Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from interior.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

Entrance Doors: Reinforce doors as required for installing entrance door hardware.

Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: **BLACK ANODIZED**

PART 3 - EXECUTION

3.1 INSTALLATION

General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

Metal Protection:

7. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.

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8. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.
Install components plumb and true in alignment with established lines and grades.
Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
Install glazing as specified in Section 088000 "Glazing."
Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
9. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
10. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.2 ENTRANCE DOOR HARDWARE SET

1. See Construction Documents for full hardware schedule.

END OF SECTION 084113

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SECTION 087100 – DOOR HARDWARE

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 commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Hollow Metal Doors and Frames".
 - 2. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. UL/ULC and CSA C22.2 – Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
 - 8. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series
 - 2. UL10C – Positive Pressure Fire Tests of Door Assemblies

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1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- D. Informational Submittals:
1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

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- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
- E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
 - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.

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3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 1. Structural failures including excessive deflection, cracking, or breakage.
 2. Faulty operation of the hardware.
 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

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- D. Special Warranty Periods:
1. Seven years for heavy duty cylindrical (bored) locks and latches.
 2. Five years for exit hardware.
 3. Twenty five years for manual surface door closer bodies.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.
1. Quantity: Provide the following hinge quantity, unless otherwise indicated:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 2. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:

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- a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
- 3. Acceptable Manufacturers:
 - a. Ives.
 - b. Hager Companies (HA).
 - c. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
- B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
 - 1. Acceptable Manufacturers:
 - a. Ives.
 - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
 - c. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.3 DOOR OPERATING TRIM

- A. Flush Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
 - 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
 - 2. Furnish dust proof strikes for bottom bolts.
 - 3. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 - 4. Acceptable Manufacturers:
 - a. Door Controls International (DC).
 - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
 - c. Trimco (TC).
 - d. Ives.
- B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
 - 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 - 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 - 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 - 4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

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5. Acceptable Manufacturers:

- a. Hiawatha, Inc. (HI).
- b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
- c. Trimco (TC).
- d. Ives.

2.4 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Cylinders: Original manufacturer cylinders complying with the following:
 1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
 4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
- C. Keying System: Each type of lock and cylinders to be factory keyed.
 1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 3. Existing System: Key locks to Owner's existing system.
- D. Key Quantity: Provide the following minimum number of keys:
 1. Change Keys per Cylinder: Two (2)
 2. Master Keys (per Master Key Level/Group): Five (5).
 3. Construction Keys (where required): Ten (10).
- E. Construction Keying: Provide construction master keyed cylinders.
- F. Key Registration List (Bitting List):
 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 2. Provide transcript list in writing or electronic file as directed by the Owner.

2.5 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Grade 1 certified.
 1. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.

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2. Locks are to be non-handed and fully field reversible.
3. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) – CL3300 Series.
 - b. Sargent Manufacturing (SA) – 10 Line.
 - c. Schlage (SC) – ND Series.
 - d. Yale Locks and Hardware (YA) 5400LN Series.

B. Interconnected Locksets: ANSI/BHMA A156.12, Series 5000. Grade 2.

1. Interconnected locksets designed with an interlocking tubular chassis and latchbolt and allow simultaneous retraction of latchbolt and deadbolt with a single motion turning of the lever/knob.
2. Locksets to be UL listed for use on a fire door.
3. Locksets to be field adjustable for center to center dimension.
4. Locksets to be non-handed, and have a 2 3/8" standard backset.
5. Acceptable Manufacturers:
 - a. Schlage (SC) – H Series.
 - b. Yale Residential (YR) - YH Series.

2.6 LOCK AND LATCH STRIKES

- A. Strikes:** Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
- B. Standards:** Comply with the following:
1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 3. Dustproof Strikes: BHMA A156.16.

2.7 CONVENTIONAL EXIT DEVICES

- A. General Requirements:** All exit devices specified herein shall meet or exceed the following criteria:
1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as

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required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 3. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 4. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.
 5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 9. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
 - b. Sargent Manufacturing (SA) - 80 Series.
 - c. Von Duprin (VD) – 35A/98A Series.

2.8 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:

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1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
 4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
 5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 certified surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.
1. Acceptable Manufacturers:
 - a. LCN – 4040 Series
 - b. Corbin Russwin Hardware (RU) - DC6000 Series.
 - c. Norton Door Controls (NO) - 8500 Series.
 - d. Yale Locks and Hardware (YA) - 3500 Series.

2.9 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
 - B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
1. Acceptable Manufacturers:

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- a. Ives.
- b. Hiawatha, Inc. (HI).
- c. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
- d. Trimco (TC).

2.10 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Acceptable Manufacturers:
 1. National Guard Products (NG).
 2. Pemko Products (PE).
 3. Reese Enterprises, Inc. (RE).

2.11 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.12 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

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- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage,

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and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

END OF SECTION 087100

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GLAZING

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Glass for doors storefront framing.
 - 2. Glazing sealants and accessories.

1.2 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 QUALITY ASSURANCE

- A. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.5 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to 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. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cardinal Glass Industries.
 2. Guardian Glass; SunGuard.
 3. Oldcastle BuildingEnvelope™.
 4. Pilkington North America.
 5. Vetrotech Saint-Gobain.
 6. Vitro Architectural Glass.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the International Building Code and ASTM E1300.
1. Design Wind Pressures: As indicated on Drawings.
 2. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- B. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
 2. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: "Glazing Manual."
 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

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- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

2.5 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190.
 - 1. Sealing System: Dual seals.
 - 2. Perimeter Spacer: Aluminum with black, color anodic finish.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Technoform Glass Insulation NA, Inc.
 - 2) Thermix; a brand of Ensinger USA.

2.6 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 100/50, Use NT.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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- a. [Dow Corning Corporation.](#)
- b. [GE Construction Sealants; Momentive Performance Materials Inc.](#)
- c. [Pecora Corporation.](#)
- d. [Sika Corporation.](#)
- e. [Tremco Incorporated.](#)

2.7 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
 1. AAMA 804.3 tape, where indicated.
 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- B. Setting Blocks:
 1. Type recommended by sealant or glass manufacturer.
- C. Spacers:
 1. Type recommended by sealant or glass manufacturer.
- D. Edge Blocks:
 1. Type recommended by sealant or glass manufacturer.
- E. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

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PART 3 - EXECUTION

3.1 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

3.2 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Apply heel bead of elastomeric sealant.
- F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

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- G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.3 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.4 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. 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 buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass

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manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

- C. Remove and replace glass that is damaged during construction period.

3.6 INSULATING GLASS SCHEDULE

- A. Glass Type GL-1: Low-E-coated, Tempered, clear insulating glass. Storefront glazing / sidelites / door panels
1. Overall Unit Thickness: 1 inch.
 2. Minimum Thickness of Each Glass Lite: 6 mm.
 3. Outdoor Lite: Fully tempered float glass.
 4. Interspace Content: Air.
 5. Indoor Lite: Fully tempered float glass.
 6. Low-E Coating: Pyrolytic on second surface.
 7. Safety glazing required.
- B. Glass Type GL-2: Low-E-coated, clear insulating glass. Storefront glazing
1. Overall Unit Thickness: 1 inch.
 2. Minimum Thickness of Each Glass Lite: 6 mm.
 3. Outdoor Lite: Float glass.
 4. Interspace Content: Air.
 5. Indoor Lite: Float glass.
 6. Low-E Coating: Pyrolytic on second surface.
 7. Solar Heat Gain Coefficient: 0.30 maximum
 8. Spacer Color: Black
 9. Safety glazing required

END OF SECTION 088000

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SECTION 092900 - GYPSUM BOARD

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. Section Includes:
 - 1. Interior gypsum board.
 - 2. Tile backing panels.
- B. Related Requirements:
 - 1. Section 061000 ROUGH CARPENTRY

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are 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.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

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2.2 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Gypsum.
 2. CertainTeed Corp.
 3. Georgia-Pacific Gypsum LLC.
 4. Lafarge North America Inc.
 5. National Gypsum Company.
 6. Temple-Inland.
 7. USG Corporation.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
1. Thickness: 5/8 inch.
 2. Long Edges: Tapered.
- C. Moisture-and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
1. Core: 5/8 inch Type X.
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D 3273, score of 10.

2.3 TILE BACKING PANELS

- A. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M, with manufacturer's standard edges.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Gypsum.
 - b. CertainTeed Corp.
 - c. Georgia-Pacific Gypsum LLC.
 - d. Lafarge North America Inc.
 - e. PABCO Gypsum.
 - f. Temple-Inland.
 - g. USG Corporation.
 2. Core: 5/8 inch, Type X.

2.4 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. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.

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2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
- C. Joint Compound for Interior Gypsum Board: 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 drying-type, all-purpose compound.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose 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.

2.6 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.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
 - b. Grabber Construction Products; Acoustical Sealant GSC.
 - c. Pecora Corporation; AC-20 FTR.
 - d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - e. USG Corporation; SHEETROCK Acoustical Sealant.
- F. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."

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- G. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc., except in chases braced internally).
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. 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.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

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- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
1. Type X: Vertical and ceiling surfaces unless otherwise indicated.
 2. Moisture- and Mold-Resistant Type: As indicated on Drawings.
- B. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 3. On Hat and Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 APPLYING TILE BACKING PANELS

- A. Water-Resistant Backing Board: Install where indicated with 1/4-inch gap where panels abut other construction or penetrations.
- B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 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. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners.
 2. Z-Shadow-Bead: Use at edges of door and window frames.
 3. L-Bead: Use where indicated.
 4. U-Bead: Use at exposed panel edges.

3.6 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.

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- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. 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 09 9113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Concrete.
 - 2. Concrete masonry units (CMU).
 - 3. Steel.
 - 4. Galvanized metal.
 - 5. Aluminum (not anodized or otherwise coated).
 - 6. Stainless-steel flashing.
 - 7. Wood.
 - 8. Plastic trim fabrications.
 - 9. Exterior gypsum board.
 - 10. Fiber cement siding & trim.
 - 11. Exterior Insulation Finish System.

1.2 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523, a matte flat finish.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, a high-side sheen flat, velvet-like finish.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, an eggshell finish.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523, a satin-like finish.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523, a semi-gloss finish.
- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523, a gloss finish.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. 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.
 - 3. VOC content.

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1.4 CLOSEOUT SUBMITTALS

- A. Coating Maintenance Manual: Provide coating maintenance manual including area summary with finish schedule, area detail designating location where each product/color/finish was used, product data pages, material safety data sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials[, **from the same product run,**] that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 1 gal. (3.8 L) of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups 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. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacture's label with the following information:
 - 1. Product name and type (description).
 - 2. Batch date.
 - 3. Color number.
 - 4. VOC content.
 - 5. Environmental handling requirements.
 - 6. Surface preparation requirements.
 - 7. Application instructions.
- B. 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.

1.8 FIELD 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).

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- B. Do not apply paints in snow, rain, fog, or mist; 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.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company products indicated or comparable product from one of the following:
 - 1. Sherwin Williams
 - 2. Benjamin Moore & Co.
 - 3. Duron, Inc.
 - 4. Glidden Professional, Division of PPG Architectural Finishes, Inc.
 - 5. PPG Architectural Finishes, Inc.
- B. Source Limitations: Obtain paint materials from single source from single listed manufacturer.
 - 1. Manufacturer's designations listed on a separate color schedule are for color reference only and do not indicate prior approval.

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. 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.
- C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.
- D. Colors: As indicated on Construction Documents.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 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

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Painted surfaces if, on repainting with complying materials, the two paints are incompatible.

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 the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
 - 1. Report, in writing, conditions that may affect application, appearance, or performance of paint.
- B. Substrate Conditions:
 - 1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - a. Concrete: 12 percent.
 - b. Masonry (Clay and CMU): 12 percent.
 - c. Wood: 15 percent.
 - d. Portland Cement Plaster: 12 percent.
 - e. Gypsum Board: 12 percent.
 - 2. Portland Cement Plaster Substrates: Verify that plaster is fully cured.
 - 3. Exterior Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected; application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and 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.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat 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. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

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- F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
 - 1. SSPC-SP 2, "Hand Tool Cleaning."
 - 2. SSPC-SP 3, "Power Tool Cleaning."
 - 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
 - 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Aluminum Substrates: Remove loose surface oxidation.
- J. Wood Substrates:
 - 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
 - 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. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 - 4. Paint entire exposed surface of window frames and sashes.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. 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 Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety

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and Security Work:

1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

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 EXTERIOR PAINTING SCHEDULE

- A. Concrete, Clay Masonry, Portland Cement Plaster (Stucco), Cementitious Siding, Nontraffic Surfaces:
 1. Latex System:
 - a. Prime Coat: Primer sealer, latex, exterior, S-W Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 mils wet, 3.2 mils dry.
 - b. Prime Coat: Latex, exterior, matching topcoat.
 - c. Intermediate Coat: Latex, exterior, matching topcoat.
 - d. Topcoat: Latex, exterior, flat: S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.
 - e. Topcoat: Latex, exterior, low-sheen: S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
 - f. Topcoat: Latex, exterior, satin: S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
 - g. Topcoat: Latex, exterior, semi-gloss: S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

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- h. Topcoat: Latex, exterior, gloss: S-W A-100 Exterior Latex Gloss, A8 Series, at 4.0 mils wet, 1.3 mils dry, per coat.
 - 2. Latex Aggregate/Latex System:
 - a. Prime Coat: Block Filler, Latex, Interior/Exterior: S-W Loxon Block Surfer, A24W200, at 50 to 100 sq ft/gal.
 - b. Topcoat: Latex, exterior flat: S-W UltraCrete Textured Masonry Topcoat, A44-800 Series, at 50 to 80 sq ft/gal.
 - 3. Concrete Stain System (Water-based):
 - a. First Coat: Low-luster opaque finish matching topcoat.
 - b. Topcoat: Low-luster opaque finish: S-W H&C Concrete Stain Solid Color Water Based, A31 Series, at 50 to 250 sq. ft. per gal.
- B. CMU Substrates:
 - 1. Latex System:
 - a. Block Filler: Block filler, latex, interior/exterior: S-W PrepRite Block Filler, B25W25, at 75 to 125 sq. ft. per gal.
 - b. Prime Coat: Primer sealer, latex, exterior, S-W Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 mils wet, 3.2 mils dry.
 - c. Intermediate Coat: Latex, exterior, matching topcoat.
 - d. Topcoat: Latex, exterior, flat: S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.
 - e. Topcoat: Latex, exterior, low-sheen: S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
 - f. Topcoat: Latex, exterior, satin: S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
 - g. Topcoat: Latex, exterior, semi-gloss: S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
 - h. Topcoat: Latex, exterior, gloss: S-W A-100 Exterior Latex Gloss, A8 Series, at 4.0 mils wet, 1.3 mils dry, per coat.
- C. Ferrous Metal, Galvanized-Metal, and Aluminum Substrates:
 - 1. Water-Based Light Industrial Coating System:
 - a. Prime Coat: Primer, water-based, anti-corrosive for metal: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, 5.0 to 10.0 mils wet, 2.0 to 4.0 mils dry.
 - b. Prime Coat: Shop primer specified in Section where substrate is specified.
 - c. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - d. Topcoat: Light industrial coating, exterior, water based, eggshell: S-W Pro Industrial Eg-Shel Acrylic B66-660 Series, at 2.5 to 4.0 mils dry, per coat.
 - e. Topcoat: Light industrial coating, exterior, water based, semi-gloss: S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.
 - f. Topcoat: Light industrial coating, exterior, water based, gloss: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series, at 2.5 to 4.0 mils dry, per coat.
- D. Wood Substrates: Including exposed wood items not indicated to receive shop-applied finish.
 - 1. Latex System:
 - a. Prime Coat: Primer, latex for exterior wood.
 - a. Intermediate Coat: Latex, exterior, matching topcoat.
 - b. Topcoat: Latex, exterior, flat: S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.
 - c. Topcoat: Latex, exterior, low-sheen: S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

EXTERIOR PAINTING

- d. Topcoat: Latex, exterior, satin: S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
 - e. Topcoat: Latex, exterior, semi-gloss: S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
 - f. Topcoat: Latex, exterior, gloss: S-W A-100 Exterior Latex Gloss, A8 Series, at 4.0 mils wet, 1.3 mils dry, per coat.
- E. Plastic Trim Fabrication Substrates: Including architectural PVC, plastic, and fiberglass items.
- 1. Latex System:
 - a. Prime Coat: Primer, bonding, water-based: S-W PrepRite ProBlock Latex Primer/Sealer.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, flat: S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.
 - d. Topcoat: Latex, exterior, low-sheen: S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
 - e. Topcoat: Latex, exterior, satin: S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
 - f. Topcoat: Latex, exterior, semi-gloss: S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
 - g. Topcoat: Latex, exterior, gloss: S-W A-100 Exterior Latex Gloss, A8 Series, at 4.0 mils wet, 1.3 mils dry, per coat.
- F. Exterior Gypsum Board Substrates:
- 1. Latex System:
 - a. Prime Coat: Primer, bonding, water-based: S-W PrepRite ProBlock Latex Primer/Sealer.
 - b. Prime Coat: Latex, exterior, matching topcoat.
 - c. Intermediate Coat: Latex, exterior, matching topcoat.
 - d. Topcoat: Latex, exterior, flat: S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.
 - e. Topcoat: Latex, exterior, low-sheen: S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
 - f. Topcoat: Latex, exterior, satin: S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
 - g. Topcoat: Latex, exterior, semi-gloss: S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
 - h. Topcoat: Latex, exterior, gloss: S-W A-100 Exterior Latex Gloss, A8 Series, at 4.0 mils wet, 1.3 mils dry, per coat.
- G. [Exterior Insulation Finish Systems (EIFS)] [Vinyl Siding]:
- 1. Latex System:
 - a. First Coat: Latex, exterior, matching topcoat.
 - b. Topcoat: Latex, exterior, flat: S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.
 - c. Topcoat: Latex, exterior, low-sheen: S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
 - d. Topcoat: Latex, exterior, satin: S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
 - e. Topcoat: Latex, exterior, semi-gloss: S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
 - f. Topcoat: Latex, exterior, gloss: S-W A-100 Exterior Latex Gloss, A8 Series, at 4.0

EXTERIOR PAINTING

mils wet, 1.3 mils dry, per coat.

END OF SECTION 099113

**RELEASE FOR
CONSTRUCTION
AS NOTED ON PLANS REVIEW
DEVELOPMENT SERVICES
LEE'S SUMMIT, MISSOURI**

07/16/2020

07/16/2020

ARCHITECTURAL CANOPIES

SECTION 107320 – ARCHITECTURAL CANOPIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes metal architectural canopies.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 - 1. Include fabrication and installation layouts of metal canopy; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 - 2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
- C. Samples for Verification: For each type of each exposed finish required.
- D. Delegated-Design Submittal: For hanger rod attachment to building.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Retain strippable protective covering on metal panels during installation.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

07/16/2020

1.7 COORDINATION

- A. Field Measurements: Confirm dimensions prior to preparation of shop drawings.
- B. Coordinate architectural canopy installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design: Subject to compliance with requirements, provide Super Lumideck Flat Soffit Hanger Rod & Cantilevered Canopy or an approved comparable product.
- B. Fascia: Manufacturer's standard extruded minimum 0.125 aluminum. Provide with drain and scuppers as located on the Drawings.
 - 1. Profile: 8-inch "J" style
 - 2. Finish: Two-coat fluoropolymer.
 - a. Color: Black
- C. Flush-Profile Metal Soffit Panels: Solid aluminum panels formed with vertical panel edges and a flat pan between panel edges; with flush joint between panels.
 - 1. Panel: 3-inch wide x 0.078
 - 2. Surface: Smooth, flat
 - 3. Exterior Finish: Two-coat fluoropolymer
 - a. Color: Black
 - 4. Color: As selected by Architect from manufacturer's full range.
- D. Rod Hanger: Manufacturers standard 1-inch schedule 40 pipe assembly connected to extruded canopy support beam and to building with a machine bolt assembly.
 - 1. Escutcheon Plate: Square

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ARCHITECTURAL CANOPIES

2.2 FABRICATION

- A. Fabricate and finish metal architectural canopy and accessories at the factory, by manufacturer's standard procedures and processes for field assembly.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, blocking, and other conditions affecting performance of the Work.
 - 1. Additional blocking and bracing at canopy connection points to adequately handle canopy loads to be supplied, fabricated and installed by others.
- B. Installer shall confirm that existing dimensions and elevations match approved shop drawings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install canopy according to manufacturer's written instructions in orientation, sizes, and locations indicated. Anchor hanger pipe securely in place, with provisions for thermal and structural movement.
 - 1. Assembly all components of architectural canopy in the field utilizing 3/16 fasteners with a minimum shear stress of 350 lbs. Pre-welded or factory-welded connections are not acceptable.
 - 2. Install canopy with positive camber to ensure proper drainage.
 - 3. Wall systems with EIFS require compressions spacers to prevent crushing.
 - 4. Counterflashing and sealant shall be provided by canopy manufacturer.
 - a. Embed all wall anchor washers in sealant to provide watertight seal at wall.
 - 5. Provide weathertight escutcheons for hanger penetration.

3.3 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as canopies are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 107320

West Pryor Lot 3

**RELEASE FOR
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AS NOTED ON PLANS REVIEW
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LEE'S SUMMIT, MISSOURI
Lee's Summit, MO
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SECTION 221800 - VALVES

SECTION 224000 - PLUMBING FIXTURES AND EQUIPMENT

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SECTION 220100 - PLUMBING PROVISIONS

1. PART 1 - GENERAL

1.1. RELATED DOCUMENTS

All contract documents including drawings, alternates, addenda and modifications and general provisions of the Contract, including General and Supplementary Conditions and all other Division Specification Sections, apply to work of this section. All preceding and following sections of this specification division are applicable to the Plumbing Contractor, all sub-contractors, and all material suppliers.

1.2. SCOPE OF WORK

This DIVISION requires the furnishing and installing of complete functioning plumbing systems, and each element thereof, as specified or indicated on Drawings or reasonably inferred, including every article, device or accessory reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the Work include materials, labor, supervision, supplies, equipment, transportation, and utilities.

Refer to Architectural, Structural and Electrical Drawings and all other contract documents and to relevant equipment drawings and shop drawings to determine the extent of clear spaces and make all offsets required to clear equipment, beams and other structural members to facilitate concealing piping and ductwork in the manner anticipated in the design.

1.3. SPECIFICATION FORM AND DEFINITIONS

The Engineer indicated in these specifications is Pearson Kent McKinley Raaf Engineers LLC. 2933 SW Woodside Dr, Suite C, Topeka, KS, 66614, PHONE 785-273-2447, FAX 785-273-0456, EMAIL scott.mckinley@pkmreng.com.

Contractor, wherever used in these specifications, shall mean the Company that enters into contract with the Owner to perform this section of work.

When a word, such as "proper", "satisfactory", "equivalent", and "as directed", is used, it requires the Architect-Engineer's review. "Provide" means to furnish and install in a satisfactory working condition.

1.4. QUALIFICATIONS

The contractors responsible for work under this section shall have completed a job of similar scope and magnitude within the last 3 years. The contractors shall employ an experienced, competent and adequate work force licensed in their specific trade and properly supervised at all times. Unlicensed workers and general laborers shall be adequately supervised to insure competent and quality work and workmanship required by this contract and all other regulations, codes and practices. At all times the contractors shall comply with all applicable local, state and federal guidelines, practices and regulations. Contractor may be required to submit a statement of qualifications upon request before any final approval and selection. Failure to be able to comply with these requirements is suitable reason for rejection of a bid.

1.5. LOCAL CONDITIONS

The contractor shall visit the site and determine the existing local conditions affecting the work required. Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

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1.6. CONTRACT CHANGES

Changes or deviations from the contract documents; including those for extra or additional work must be submitted in writing for review of Architect-Engineer. No verbal change orders will be recognized.

1.7. LOCATIONS AND INTERFERENCES

Locations of equipment, piping and other mechanical work are indicated diagrammatically by the mechanical drawings. The Contractor shall determine the exact locations on site, subject to structural conditions, work of other Contractors, and access requirements for installation and maintenance to approval of Architect-Engineer. Provide additional piping and ductwork offsets as required at no additional cost.

Study and become familiar with the contract drawings of other trades and in particular the general construction plans and details in order to obtain necessary information for figuring installation.

Cooperate with other contractors and install work in such a way as to avoid interference with their work. Minor deviations, not affecting design characteristics, performance or space limitation may be permitted if reviewed prior to installation by Architect-Engineer.

Any pipe, ductwork, equipment, apparatus, appliance or other item interfering with proper placement of other work as indicated on drawings, specified, or required, shall be removed, relocated and reconnected without extra cost. Damage to other work caused by this Contractor, the Subcontractor, or workers shall be restored as specified for new work.

Do not scale mechanical and electrical drawings for dimensions. Contractor shall accurately layout work from the dimensions indicted on the Architectural drawings unless they are found to be in error.

1.8. PERFORMANCE

Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification division.

The Contractor warrants to the Owner and Architect-Engineer the quality of materials, equipment, workmanship and operation of equipment provided under this specification division for a period of one year from and after completion of building and acceptance of mechanical systems by Owner.

1.9. WARRANTY

The Contractor warrants to the Owner and Architect-Engineer that upon notice from them within a one year warranty period following date of acceptance, that all defects that have appeared in materials and/or workmanship, will be promptly corrected to original condition required by contract documents at Contractor's expense. The above warranty shall not supersede any separately stated warranty or other requirements required by law or by these specifications.

1.10. ALTERNATES

Refer to General Requirements for descriptions of any alternates that may be included.

1.11. MATERIALS, EQUIPMENT AND SUBSTITUTIONS

The intent of these specifications is to allow ample opportunity for Contractor to use his ingenuity and abilities to perform the work to his and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required. Material and equipment installed under this contract shall be first class quality, new, unused and without damage.

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In general, these specifications identify required materials and equipment by naming one or more manufacturer's brand, model, catalog number and/or other identification. The first named manufacturer or product is used as the basis for design; other manufacturers named must furnish products consistent with specifications of first named product as determined by Engineer. Base bid proposal shall be based only on materials and equipment by manufacturers named, except as hereinafter provided.

Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to Architect-Engineer for review prior to procurement.

Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color as determined by Architect-Engineer whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by two copies of complete descriptive and technical data including manufacturer's name, model and catalog number, photographs or cuts, physical dimensions, operating characteristics and any other information needed for comparison.

If the Contractor wishes to incorporate products other than those named in the Base Bid Specifications they shall submit a request for approval of equivalency in writing no later than (10) ten calendar days prior to bid date. Substitutions after this may be refused at Engineers option. Equivalents will ONLY be considered approved when listed by addendum.

In proposing a substitution prior to or subsequent to receipt of bids, include in such bid the cost of altering other elements of this project, including adjustments in mechanical or electrical service requirements necessary to accommodate such substitution.

Within 10 working days after bids are received, the apparent low bidder shall submit to the Architect-Engineer for approval, three copies of a list of all major items of equipment they intend to provide. Within 30 working days after award of Contract, Contractor shall submit shop drawings for equipment and materials to be incorporated in work, for Architect-Engineer review. Where 30-day limit is insufficient for preparation of detailed shop drawings on major equipment or assemblies, Contractor shall submit manufacturer's descriptive catalog data and indicate date such detailed shop drawings will be submitted along with manufacturer's certification that order was placed within 30 working day limit.

1.12. ELECTRONIC PLAN FILES

Electronic files of the contract documents may be available from the Engineer to successful bidders and manufacturers for a fee of \$50 per sheet, \$100 minimum and \$25 email/shipping charge. A release of liability form will be required along with payment prior to release of files.

1.13. OPENINGS, ACCESS PANELS AND SLEEVES

This Contractor shall include the installation of all boxes, access panels and sleeves for openings required to install this work, except structural openings incorporated in the structural drawings. Sleeves shall be installed for all pipes passing through structural slabs and walls. Contractor shall set and verify the location of sleeves that pass through beams, as shown on structural plans. All floor and wall penetrations shall be sealed to meet fire-rating requirements.

1.14. ARCHITECTURAL VERIFICATION AND RELATED DOCUMENTS

Contractor shall consult all Architectural Drawings and specifications in their entirety incorporating and certifying all millwork, furniture, and equipment rough-in including utility characteristics such as

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voltage, phase, amperage, pipe sizes, duct sizes, including height, location and orientation. Shop drawings incorporating these requirements should be submitted to the Architect for approval prior to installation or rough in.

1.15. EXTENT OF CONTRACT WORK

Provide mechanical systems indicated on drawings, specified or reasonably implied. Provide every device and accessory necessary for proper operation and completion of mechanical systems. In no case will claims for "Extra Work" be allowed for work about which Contractor could have been informed before bids were taken.

Contractor shall become familiar with equipment provided by other contractors that require mechanical connections and controls.

Electrical work required to install and control mechanical equipment, which is not shown on plans or specified under Division 26, shall be included in Contractor's base bid proposal. All automatic temperature control devices shall be mounted as indicated in automatic temperature control section of specifications.

The cost of larger wiring, conduit, control and protective devices resulting from installation of equipment which was not used for basis of design as outlined in specifications shall be paid for by Mechanical Contractor at no cost to Owner or Architect-Engineer.

Contractor shall be responsible for providing supervision to Electrical Contractor to insure that required connections, interlocking and interconnection of mechanical and electrical equipment are made to attain intended control sequences and system operation.

Furnish four complete sets of electrical wiring diagrams to Architect-Engineer to be included in the maintenance manuals and three complete sets to Electrical Contractor. Diagrams shall show factory and field wiring of components and controls. Control devices and field wiring to be provided by Electrical Contractor shall be clearly indicated by notation and drawing symbols on wiring diagrams.

Contractor shall obtain complete electrical data on mechanical shop drawings and shall list this data on an approved form that shall be presented monthly or on request, to Electrical Contractor. Data shall be complete with wiring diagrams received to date and shall contain necessary data on electrical components of mechanical equipment such as HP, voltage, amperes, watts, locked rotor current to allow Electrical Contractor to order electrical equipment required in his contract.

1.16. WORK NOT INCLUDED IN CONTRACT

Consult Division 26 of specifications for work to be provided by Electrical Contractor in conjunction with installation of mechanical equipment.

1.17. CODES, RULES AND REGULATIONS

Provide Work in accordance with applicable codes, rules and regulations of Local and State, Federal Governments and other authorities having lawful jurisdiction.

Conform to latest editions and supplements of following codes, standards or recommended practices.

1.17.1. CODES:

2006 International Building Code

2006 International Fire Code

2006 International Mechanical Code

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2006 International Plumbing Code

2008 National Electrical Code

1991 Americans with Disabilities Accessibility Guidelines (ADAAG).

1.17.2. SAFETY CODES:

National Electrical Safety Code Handbook H30 - National Bureau of Standards.

Occupational Safety and Health Standard (OSHA) - Department of Labor.

1.17.3. NATIONAL FIRE CODES:

NFPA No. 13 Standard for the installation of Sprinkler Systems

NFPA No. 14 Standard for the installation of Standpipe and Hose Systems

NFPA No. 54 Gas Appliance & Gas Piping Installation

NFPA No. 70 National Electrical Code

NFPA No. 89M Clearances, Heat Producing Appliances

NFPA No. 90A Air Conditioning and Ventilating Systems

NFPA No. 91 Blower & Exhaust System

NFPA No. 101 Life Safety Code

NFPA No. 204 Smoke & Heating Vent Guide

1.17.4. UNDERWRITERS LABORATORIES INC:

All materials, equipment and component parts of equipment shall bear UL labels whenever such devices are listed by UL.

1.17.5. MISCELLANEOUS CODES:

ANSI A117.1 - Handicapped Accessibility, ASHRAE 90.1 – 1999, Kansas State Boiler Code, Americans with Disabilities Act (ADA)

2. PART 2 – PRODUCTS

Not Used

3. PART 3 - EXECUTION

3.1. SHOP DRAWINGS

Contractor shall furnish a minimum of six sets of shop drawings of all materials and equipment. Architect-Engineer will retain three sets.

Contractor shall submit two sets of prints of all fabrication drawings. Cost of drawing preparation, printing and distribution shall be paid for by the contractor and included in his base bid.

Where catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, fitting sizes, etc. that are to be provided. Mark each submitted item with applicable section and sheet number of these specifications, or plan sheet number when item does not appear in the specifications. Where equipment submitted does not appear in base specifications or specified equivalent, mark submittals with applicable alternate numbers, change order number or letters of authorization. Each submittal shall contain at least two sets of original catalog cuts. Each catalog sheet shall bear the equipment manufacturer's name and address. All shop drawings on materials and equipment listed by UL shall indicate UL approval on submittal.

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Contractor shall check all shop drawings to verify that they meet specifications and/or drawings requirements before forwarding submittals to the Architect-Engineer for their review. All shop drawings submitted to Architect-Engineer shall bear contractor's approval stamp that shall indicate that Contractor has reviewed submittals and that they meet specification and/or drawing requirements. Contractor's submittal review shall specifically check for but not be limited to the following: equipment capacities, physical size in relation to space allowed; electrical characteristics, provisions for supply, return and drainage connections to building systems. All shop drawings not meeting Contractor's approval shall be returned to their supplier for re-submittal.

No shop drawing submittals will be considered for review by the Architect-Engineer without Contractor's approval stamp, or that have extensive changes made on the original submittal as a result of the Contractor's review.

The shop drawing submittal dates shall be at least as early as required to support the project schedule and shall also allow for two weeks Architect-Engineer review time plus mailing time plus a duplication of this time for re-submittal if required. Submittal of all shop drawings as soon as possible before construction starts is preferred. Submit the number of shop drawings required by the General Conditions but not less than 6 copies. All shop drawings submitted shall contain the following: The project name, the applicable specification section and paragraph, the submittal date, the Contractor's stamp which shall certify that the stamped drawings have been checked by the Contractor, comply with the drawings and specifications and have been coordinated with other trades. Submittals not so identified will be returned without action for re-submittal.

The Architect's-Engineer's checking and subsequent approval of such drawings, schedules, literature, or illustrations shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications unless he has, in writing, called the Architect's-Engineer's attention to such deviations at the time of submission, and secured their written approval; nor shall it relieve the contractor from responsibility for errors in dimensions, details, size of members, or omissions of components for fittings; or for coordinating items with actual building conditions and adjacent work.

Any corrections or modifications made by the Architect-Engineer shall be deemed acceptable to the Contractor at no change in price unless written notice is received by the Architect-Engineer prior to the performance of any work incorporating such corrections or modifications.

Shop drawings that require re-submission shall have the items that were revised "flagged" or in some other manner marked to call attention to what has been changed.

Before submitting shop drawings and material lists, verify that all equipment submitted is mutually compatible and suitable for the intended use. Verify that all equipment will fit the available space and allow ample room for maintenance. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.

Sheet metal shop drawings for duct fabrication shall be a minimum of 1/4" scale. Sheet metal shop drawings shall not be a reproduction of the contract document and shall show details of the following: Fabrication, assembly, and installation, including plans, elevations above finished floor, sections, components, and attachments to other work. Duct layout indicating pressure classifications and sizes on plans, fittings, reinforcement and spacing, seam and joint construction, penetrations through fire-rated and other partitions, hangers and supports, including methods for building attachment, vibration isolation, seismic restraints, and duct attachment.

Architect-Engineer's review of shop drawings will not relieve Contractor of responsibility for deviations from drawings and specifications unless the Architect-Engineer has specifically approved such deviations in writing, nor shall it relieve the Contractor of responsibility for errors in shop drawings. No work shall be fabricated until Architect-Engineer's review has been obtained.

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Any time delay caused by correcting and re-submitting shop drawings will be the Contractor's responsibility.

3.2. SUBMITTALS

Contractor shall provide the following submittal sections that apply to this project:

BASIC MECHANICAL MATERIALS AND METHODS:

Test methods and pressures, Sterilization of domestic water systems Piping, and fittings

PIPING:

Piping specialties, Supports, anchors, sleeves and seals, Valves, Piping and equipment insulation, Thermometers and gauges

PLUMBING:

Plumbing Fixtures, Water Heaters, Backflow Preventers, Sump Pumps, Plumbing Specialties

3.3. OPERATING AND MAINTENANCE INSTRUCTIONS (O & M MANUALS)

Submit with shop drawings of equipment, four copies of installation, operating, maintenance instructions, and parts lists for equipment provided. Equipment manufacturer shall prepare instructions.

Keep in safe place, keys and wrenches furnished with the equipment provided under this contract. Present to the Owner and obtain a receipt for them upon completion of project.

Prepare a complete brochure, covering systems and equipment provided and installed under this contract. Submit brochures to Architect-Engineer for review before delivery to Owner. Brochures shall contain following:

- Certified equipment drawings/or catalog data with equipment provided clearly marked as outlined above.
- Complete installation, operating, maintenance instructions and parts lists for each item of equipment.
- Special emergency operating instructions with a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to various parts of mechanical system.
- Record Set Drawings: The Contractor shall mark up a set of contract documents during construction all changes and deviations including change orders. These will be delivered to Architect-Engineer at the end of the project. After the originals are changed to reflect the blue line set, a copy shall be included in the brochure.

Provide brochures bound in three-ring binders with metal hinge. Reinforce binding edge of each sheet of loose-leaf type brochure to prevent tearing from continued usage. Clearly print on label insert of each brochure:

- Project name and address.
- Section of work covered by brochure, i.e., "Heating, Ventilating and Air Conditioning", and "Plumbing", etc.

3.4. CUTTING AND PATCHING

Contractor shall do cutting and patching of building materials required for installation of work herein specified. Do not cut or drill through structural members including wall, floors, roofs, and

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supporting structure, without the Architect's and Structural Engineer's approval and in a manner approved by them.

Make openings in concrete with concrete hole saw or concrete drill. Use of star drill or air hammer for this work will not be permitted.

Patching shall be by the contractors of the particular trade involved and shall meet approval of Architect-Engineer. Damage to building finishes, caused by installation of mechanical work shall be repaired at Mechanical Contractor's expense to approval of Architect-Engineer.

3.5. SETTING, ADJUSTMENT AND EQUIPMENT SUPPORTS

Work shall include mounting, alignment and adjustment of systems and equipment. Set equipment level on adequate foundation and provide proper anchor bolts and isolation as shown, specified or required by manufacturers in installation instructions. Level, shim and grout equipment bases as recommended by manufacturer. Mount motors, align and adjust drive shafts and belts according to manufacturer's instructions.

Equipment failures resulting from improper installation or field alignment shall be repaired or replaced by Contractor at no cost to Owner.

Provide floor or slab mounted equipment with 3-1/2" high concrete bases unless specified otherwise. Mechanical contractor shall form all pads; General contractor shall provide and place all concrete and reinforcing for said pads. Individual concrete pad shall be no less than 4" wider and 4" longer than equipment, and shall extend no less than 2" from each side of equipment.

Provide each piece of equipment or apparatus suspended from ceiling or mounted above floor level with suitable structural support, platform or carrier in accordance with best-recognized practice. Verify that structural members of buildings are adequate to support equipment and unless otherwise indicated on plans or specified, arrange for their inclusion and attachment to building structure. Provide hangers with vibration isolators.

Submit details of hangers, platforms and supports together with total weights of mounted equipment to Architect-Engineer for review before proceeding with fabrication or installation.

3.6. START-UP, CHANGEOVER, TRAINING AND OPERATIONAL CHECK

Contractor shall perform the initial start-up of the systems and equipment and shall provide necessary supervision and labor to make the first seasonal changeover of systems. Personnel qualified to start-up and service this equipment, including manufacturer's technicians, and the Owner's operating personnel shall be present during these operations.

Contractor shall be responsible for training Owner's operating personnel to operate and maintain the systems and equipment installed. Keep a record of training provided to Owner's personnel listing the date, subject covered, instructors name, names of Owner's personnel attending and total hours of instruction given each individual.

All owner-training sessions shall be orderly and well organized and shall be videotaped using digital format. At the end of the owner training, the "training tape" shall become property of the owner.

3.7. FINAL CONSTRUCTION REVIEW

At final construction review, each respective Contractor and major subcontractors shall be present or shall be represented by a person of authority. Each Contractor shall demonstrate, as directed by the Architect-Engineer, that the work complies with the purpose and intent of the contract documents. Respective Contractor shall provide labor, services, instruments or tools necessary for such demonstrations and tests.

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3.8. MINIMUM CONSTRUCTION STANDARDS

Drawings and specifications indicate minimum construction standard. Should any work indicated be sub-standard to any ordinances, laws, codes, rules or regulations bearing on work, Contractor shall promptly notify Architect-Engineer in writing before proceeding with work so that necessary changes can be made. However, if the Contractor proceeds with work knowing it to be contrary to any ordinances, laws, rules, and regulations, Contractor shall thereby have assumed full responsibility for and shall bear all costs required to correct non-complying work.

3.9. PERMITS, INSPECTIONS, AND UTILITY FEES

The Contractor shall secure and pay for necessary permits and certificates of inspection required by governmental ordinances, laws, rules or regulations. Keep a written record of all permits and inspection certificates and submit two copies to Architect-Engineer with request for final inspection.

The Contractor shall include in their base bid any fees or charges by the local utility providers to establish new services to the structure. Coordinate with the utility suppliers to verify exactly which part of the work required for the new utility service, is to be performed by the contractor and which part will be supplied by the utility company.

END OF SECTION 220100

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SECTION 220500 - BASIC PLUMBING MATERIALS AND METHODS

1. PART 1 - GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2. PART 2 – PRODUCTS

Not Used

3. PART 3 - EXECUTION

3.1. TESTING PROCEDURES FOR PIPING SYSTEMS

Test all lines and systems before they are insulated, painted or concealed by construction or backfilling. Provide fuel, water, electricity, materials, labor and equipment required for tests.

Where entire system cannot be tested before concealment, test system in sections. Verify that system components are rated for maximum test pressures to be applied. Where specified test pressures exceed component ratings, remove or isolate components from system during tests. Upon completion, each system shall be tested as an entire system.

Repair or replace defects, leaks and material failures revealed by tests and then retest until satisfactory. Make repairs with new materials.

3.2. TEST METHODS AND PRESSURES

Test methods and pressures shall be as follows:

3.3. Hydrostatic Test (Closed Systems):

Hydrostatic test shall be performed using clean unused domestic water. Test pressures shall be as scheduled for system or 150% of operating pressure where not specified.

3.4. Hydrostatic Test (Open System):

Test entire system with 10-foot head of water. Where system is tested in sections each joint in building except uppermost 10 feet of system shall be submitted to at least 10-foot head of water. Water shall be held in system for 15 minutes before inspection starts. System shall hold test pressure without leaks.

3.5. Pneumatic Test:

Test entire system with compressed air. Systems operating above 25 PSI shall be tested at 75 PSI or 15% of operating pressure or whichever is greater.

Allow at least 1 hour after test pressure has been applied before making initial test.

Curing test, completely isolate entire system from compressor or other sources of air pressure.

3.6. Pressure Relief and Safety Valve:

Before installation, test pressure temperature, and safety relief valves to confirm relief settings comply with specifications.

Tag items that pass test with date of test, observed relief pressure setting and inspector's signature.

Items installed in systems without test tag attached will be rejected.

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All systems shall hold scheduled test pressures for specified time without loss of initial test pressure.

Upon completion of testing submit five copies of a typewritten report to A/E. Report shall list systems tested, test methods, test pressures, holding time and all failures with corrective action taken.

3.7. STERILIZATION OF DOMESTIC WATER SYSTEMS

After final pressure testing of distribution system thoroughly flush entire system with water until free of dirt and construction debris. Fill system with solution of liquid chlorine or hypochlorite of not less than 50 PPM. Retain treated water in system until test indicates non-spore-forming bacteria have been destroyed or for 24 hours whichever is greater.

All points in systems shall have at least 10 PPM of solution at end of retention period. Open and close each valve at least six times in system during sterilization process to sterilize valve parts.

When time and concentration conditions have been met, drain system and flush with fresh domestic water until residual cleaning solution is less than 1.0 PPM. Open and close each valve in system six times during flushing operation.

Test samples taken from several points in system shall indicate absence of pollution for two full days. Repeat sterilization as required. Acceptance of system will not be given until satisfactory bacteriological results are obtained.

3.8. CLEANING OF SYSTEMS AND EQUIPMENT

After pressure testing of systems and equipment and before operational test thoroughly clean interiors of piping and equipment. Clean equipment as recommended by equipment manufacturers. Where specific instructions are not provided clean equipment systems as follows:

Air Handling Systems: Before starting any air system clean all debris, foreign matter and construction dirt from air system and fan. Provide equipment requiring filters, such as air handling units, fan coil units, blower, etc., with throw-away filters. After cleaning air system install temporary filters and run continuously for a minimum of eight hours at full volume before installing permanent filters. Provide temporary throw-away filters in all permanent heating and air conditioning equipment systems being utilized during construction. Prior to testing and balancing systems remove temporary filter media and install clean unused filters of the type specified. Clean filters shall be installed in equipment by mechanical contractor before final acceptance inspection by Architect and Engineer.

3.9. MAINTENANCE OF SYSTEMS

Contractor shall be responsible for operation, maintenance and lubrication of equipment installed under this contract.

Keep a complete record of equipment maintenance and lubrication and submit two copies with request for final construction review.

Records shall indicate types of lubricants used and date or time when next maintenance or lubrication will need to be performed by Owner. Where special lubricants are required, Contractor shall provide Owner with a one year supply as determine by Equipment Manufacturer's recommendations.

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3.10. PAINTING OF MATERIALS AND EQUIPMENT

Touch-up painting and refinishing of factory applied finishes shall be by Mechanical Contractor. Contractor shall be responsible for obtaining proper type of painting materials and color from equipment manufacturer.

Unless specified otherwise factory built equipment shall be factory painted. Paint shall be applied over surfaces only after they have been properly cleaned and coated with a corrosion resistant primer.

After installation, damage to painted surfaces shall be properly prepared and primed with primers equal to factory materials. Finish coating shall be same color and type as factory finish.

Where extensive refinishing is required equipment shall be completely repainted.

3.11. PIPING IDENTIFICATION

Provide pipe markers at 10'-0" maximum spacing to identify piping in mechanical rooms and 20'-0" maximum spacing in all other areas with Seaton setmark pipe markers with letters and flow direction arrows. Colors and wording shall be of standard pipe markers as available from Seaton or equal. Submit for approval list of colors and wording prior to purchase of pipe markers. Pipe markers shall meet applicable ANSI Standard and OSHA requirements.

3.12. HAND DAMPER IDENTIFICATION

Provide orange fluorescent tape marking on all hand dampers. Marking shall be located on the outside on the insulation and visible from the finished floor elevation.

3.13. VALVE IDENTIFICATION

Mark all valves with Seton No. 300-BL brass identification tags with system legend, valve number and size stamped on tag. Lettering shall be black ½" high. Tags shall be minimum 2" in diameter and attached to valve with Seton No. 16 brass jack chain.

Prepare four copies of typewritten list of valve tags. List shall be typed in upper case and contain tag number, valve size, type, function and location. Frame one list under glass and mount near operating instruction in main equipment rooms.

3.14. EXCAVATION AND BACKFILL

Perform necessary excavation to receive Work. Provide necessary sheathing, shoring, cribbing, tarpaulins, etc. for this operation, and remove it at completion of work. Perform excavation in accordance with appropriate section of these specifications, and in compliance with OSHA Safety Standards.

Excavate trenches of sufficient width to allow ample working space, and no deeper than necessary for installation work.

Conduct excavations so no walls or footings are disturbed or injured. Backfill excavations made under or adjacent to footing with selected earth or sand and tamp to compaction required by Architect-Engineer. Mechanically tamp backfill under concrete and pavings in six inch layers to 95% standard density, Reference Division 2.

Backfill trenches and excavations to required heights with allowance made for settlement. Tamp fill material thoroughly and moistened as required for specified compaction density. Dispose of excess earth, rubble and debris as directed by Architect.

When available, refer to test hole information on Architectural or Civil drawings or specifications for types of soil to be encountered in excavations.

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3.15. FIRE BARRIERS

Provide sleeves through all fire-rated walls and fill voids surrounding sleeves and interior to sleeves around piping with Nelson "Flameseal" fire stop putty with U.L. listed 3 hour rating installed as per manufacturers recommendations.

Equivalent by Dow, Chemelex, 3M.

All holes or voids created by the mechanical contractor to extend piping or ductwork through fire rated floors and walls shall be sealed with an intumescent material capable of expanding up to 8 to 10 times when exposed to temperatures of 250 degrees F. It shall have ICBO, BOCAI and SBCCI (NRB 243) approved ratings to 3 hours per ASTM E-814 (UL 1479). Acceptable Material: 3M Fire Barrier Caulk, Putty, Strip and sheet forms.

3.16. EQUIPMENT ANCHORS

Provide floor or foundation mounted equipment such as pumps, boilers, air handling units, etc. with Decatur Engineering Company concrete anchors.

Where equipment anchors cannot be installed during forming of floors or foundations anchor equipment with McCulloch Kwik-Bolt concrete anchors.

Anchors shall be proper type and size recommended by manufacturer for equipment to be anchored.

END OF SECTION 220500

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SECTION 221000 - PIPING

1. PART 1 - GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2. PART 2 – PRODUCTS

2.1. PIPING MATERIALS

Piping used throughout project shall conform to the following specifications. Piping shall be plainly marked with manufacturers name and weight. See piping material schedule at end of this Section for materials to be used for each piping system.

2.1.1. Cast Iron Bell and Spigot Soil Pipe:

Pipe and fittings shall be gray cast iron bell and spigot ends with lead grooves and spigot end lead beads. Pipe and fittings shall be coated inside and out with asphaltum preservative and meet requirements of current Cast Iron Soil Pipe Institute Standard HS-67 and ASTM Standard A74-69.

Seal joints with lead and oakum in accordance with current ANSI Specification A40.8 or Seal joints with neoprene pipe gaskets meeting current ASTM Standard A564-68.

Pipe and fittings by Tyler Pipe or Charlot.

2.1.2. Hubless Cast Iron Soil Pipe:

Pipe and fittings shall be gray cast iron with spigot bead and positioning lug. Pipe and fittings shall be coated inside and out with asphaltum preservative and shall meet requirements of current Cast Iron Pipe Institute Standard 301-69T.

Pipe joints shall be no-hub joint couplings consisting of neoprene rubber sleeve, stainless steel shield and clamp assembly or pipe joints shall be MB coupling consisting of cast iron housing with neoprene gasket and 18-8 stainless steel bolts and nuts.

Pipe and fittings shall be by Tyler Pipe or Charlot.

2.1.3. Ductile Iron Pipe:

Pipe: Ductile iron shall be ANSI A21.51, AWWA C151. All pipe joints shall be mechanical unless otherwise indicated. Pipe shall be color coded by blotches of paint. The Contractor shall submit a "color class" schedule of the pipe as marked by the manufacturer.

Inside coating shall be cement-mortar lining with seal coat of bituminous material in accordance with ANSI A21.4.

American Water Works Associations (AWWA) Standards:

C151-86 Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for water, or other liquids.

American National Standards Institute (ANSI):

A21.4-1985 Cement mortar lining for gray-iron and Ductile-Iron Pipe and Fittings for water.

A21.10-1987 Gray-Iron and Ductile-Iron Fittings, 3 inch through 48 inch for water and other liquids.

A21.11-1985 Rubber gasket joints for gray-iron and ductile-iron pressure pipe and fittings.

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A21.51-1986 Ductile-iron pipe centrifugally cast in metal molds for sand-lined molds for water or other liquids (AWWA C151-1981).

2.1.4. Carbon Steel Pipe (1/8" thru 2"):

Provide seamless carbon steel conforming to ASTM specification A-106.

Pipe joints shall be threaded conforming to ANSI Standard B2.1.

Pipe by Armco, Jones, Laughlin Steel Corp., Youngstown Sheet and Tube Co., or United States Steel.

2.1.5. Carbon Steel Pipe (2-1/2" and above):

Provide electric resistance welded carbon steel pipe conforming to ASTM Specification A-53.

Pipe ends shall be beveled for welding.

Pipe by Armco, Jones and Laughlin Steel Corp., Youngstown Sheet and Tube Co., or United States Steel.

2.1.6. Copper Tube:

Provide hard temper copper water tube conforming to requirements of current ASTM Specification B-88. Tubing shall be Type K, L, or M as listed in schedule. Tubing joints shall be soldered or brazed. See schedule for joining method to be used.

Pipe by Anaconda, Cerro, Chase, Mueller or Revere Copper.

2.1.7. Copper Tube Type ACR:

Provide hard temper nitrogenized copper refrigerant tube conforming to requirements of current ASTM B-88. Tubes shall be Type L or K as listed in schedule.

Tubing joints shall be brazed.

Pipe by Anaconda, Cerro, or Mueller.

2.1.8. Below Grade Pre-Insulated Chilled Water Piping:

Provide Wirsbo Ecoflex Thermo Single cross-linked polyethylene piping for below grade chilled water piping from the building to the chiller. Provide a PVC pipe long sweep pipe sleeve at the chiller cast into the chiller pad for this piping. Above grade convert to copper piping. Equivalents: Perma-Pipe poly-therm PVC, Thermal Pipe Systems, Inc. Kool-Kore PVC or equal.

2.1.9. Polyethylene Pipe:

Provide polyethylene pipe for gas service conforming to ASTM D-1248. Pipe shall be UV stabilized. SDR of 11.

Pipe by Driscopipe or equal.

2.1.10. Polyvinyl Chloride Drain Waste Pipe:

Provide Schedule 40 polyvinyl chloride plastic drain waste and vent pipe conforming to ASTM D2665-88. Joints shall be properly cleaned, primed and glued.

Pipe by Charlot, Genova, Crestline or equal.

2.2. PIPING FITTINGS

Piping fitting used throughout project shall be proper type for installation method used and shall be compatible with piping system material. Fittings listed in piping material schedule shall conform to the following specifications:

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2.2.1. Carbon Steel Welding Fittings:

Provide carbon low alloy seamless steel welding fittings conforming to current ANSI Standard B16.9 and ASTM Specification A234.

Fittings by Grinnell, Midwest or Tube Turn.

2.2.2. Branch Connection Welding Fittings:

Provide carbon steel weldolet fittings conforming to ANSI Standards B16.9, B16.11, B31.1.0 and ASTM specification A105, Grade 11.

Fittings by Bonney Forge.

2.2.3. Branch Connection, Welding to Screwed Fitting:

Provide carbon steel threadolet fitting conforming to ANSI Standards B16.9, B16.11, B31.1, and ASTM Specification A105, Grade 11.

Fittings by Bonney Forge.

2.2.4. Carbon Steel Flanges:

Provide carbon steel flanges conforming to ASTM Specification A181, Grade 1, and ANSI Standard B16.5.

Flanges by Babcock and Wilcox, Grinnell, Midwest or Tube Turn.

2.2.5. Malleable Iron Screwed Fittings:

Provide screwed malleable iron fittings conforming to ANSI Standard B16.3, and ASTM Specification A-47 grade 32510.

Fittings by Crane, Grinnell or Stockham.

2.2.6. Cast Iron Screwed Fittings:

Provide screwed cast iron fittings conforming to ANSI Standard B16.4, B2.1, and ASTM Specification A-126, Class A.

Fittings by Crane, Grinnell or Stockham.

2.2.7. Wrought Copper Fittings:

Provide wrought solder joint copper tube fitting conforming to ANSI Standard B16.22

Fittings by Anaconda, Chase or Nibco.

2.2.8. Cast Bronze Fittings:

Provide cast bronze solder joint fittings conforming to ANSI Standard B16.18.

Fittings by Anaconda, Chase or Nibco.

2.2.9. Pipe Flange Gaskets:

Provide 1/16" thick asbestos free gaskets full face or ring type as required. Gaskets shall be factory cut.

Gaskets by Durable Mfg. Co. or Garlock Company.

2.2.10. Roll Grooved Pipe Couplings:

Provide Victaulic style #07 or approved equal style (zero flex) couplings with Grade "E" gasket (EPDM compound) in mechanical areas. Provide Victaulic style #77 or approved equal style (flexible) couplings with Grade "E" gasket in other areas. Provide with ductile iron housing and nuts and bolts.

Equivalent by Grinnell.

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2.2.11. Polypropylene Joints:

Above grade joints shall be mechanical joints conforming to current ASTM Specification C-425. Below grade joints shall be fusion weld connections.

2.2.12. Ductile Iron Pipe Joints and Fittings:

Joints: Ductile iron shall be mechanical joints of the latest approved design of the manufacturer. Joints shall be so designed to guarantee a water-tight joint for the life of the pipeline.

Fittings: Ductile iron shall be short body mechanical as shown on the drawings, or required of the same pressure design as the pipe. Dimensional control and joint design shall conform to ANSI Standard A21.10 and A21.11. All fittings shall be coated as specified for the pipe. Where rods or ties are shown or called for, fittings shall be provided with anchoring lugs.

Joint Materials: Ductile Iron Joint: Mechanical joints, bolts, glands, retainer glands and gaskets, ANSI Standard A21.11.

2.2.13. PVC Fittings:

PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe. PVC Non-pressure Piping Joints: Join piping according to ASTM D 2665.

Equivalents: Spears, Lasco or equal.

2.3. PIPING AND EQUIPMENT INSULATION

Provide necessary materials and accessories for installation of insulation for plumbing and mechanical systems as specified and/or detailed on drawings insulation type, jacket, and thickness for specific piping systems or equipment shall be as listed in insulation schedule. Provide insulation materials manufactured by Armstrong Industries, Dow Chemical, Schuller, Knauf Fiberglass or Owens-Corning Fiberglas.

Insulation, except where specified otherwise, shall have composite fire and smoke hazard ratings as rested by ASTM E-84, NFPA 255, and UL 723 procedures not exceeding:

FLAME SPREAD	25
SMOKE DEVELOPED	50
FUEL CONTRIBUTED	50

Provide insulation accessories such as adhesives, mastics, cements, tape and glass fabric with same component ratings as listed above. Products or their shipping cartons shall bear label indicating their flame and smoke safety shall be permanent. Use of water soluble treatments such as corn paste or wheat paste is prohibited. This does not exclude approved lagging adhesives.

Install insulation over clean dry surfaces with joints firmly butted together. Insulation at equipment, flanges, fittings, etc. shall have straight edges with box type joints with corner beads as required. Where plumbing and heating insulation terminates at equipment or unions, taper insulation at 30 degree angle to pipe with one coat finishing cement and finish same as fittings. Total insulation system shall have neat smooth appearance with no wrinkles, or folds in jackets, joint strips or fitting covers.

Undamaged insulation systems on cold surface piping and equipment shall perform their intended functions as vapor barriers and thermal insulation without premature deterioration of insulation or vapor barrier. Contractor shall take every reasonable precaution to provide insulation systems with continuous unbroken vapor barriers.

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Where glass fabric is specified in the following insulation methods provide resin impregnated white open weave glass fabric with 10/20 thread count. Provide glass cloth similar to Alpha Martex wettable glass cloth.

Abbreviations for manufacturers of adhesive, mastics and coating specified shall be C.M. for Chicago Mastic Company and B.F. for Benjamin Foster Company.

Insulation of removable heads, manholes access covers, etc., shall be fabricated to allow removal without damage to insulation. Provide removable units with vapor-proof cover fabricated to be sealed to equipment vapor barrier.

Insulation failing to meet workmanship and appearance standards shall be replaced with an acceptable installation before final acceptance of project will be given. Insulation failing to meet performance requirements of this specification for a period of one year after date of final acceptance or through one heating season and one cooling season, whichever is longer shall be replaced with an acceptable installation. All costs to correct insulation deficiencies and costs to repair damages to other work shall be at Mechanical Contractors expense at no cost to owner.

2.4. INSULATION MATERIALS AND APPLICATION METHODS (PIPING)

Pipe insulation by type shall be as follows:

2.4.1. TYPE 1

Insulation for hot and cold surface piping systems with -20 degrees F to +850 degrees F operating range shall be by Owens-Corning Fiberglass, Schuller, or Knauf ASJ/SSL-11, 4.2 lb. density pipe insulation with white fire retardant ASJ jacket and self-sealing lap. Average thermal conductivity shall not exceed .26 BTU/Hr. at 75 degrees F mean temperature. Seal longitudinal jacket laps and butt strips with C.M. No. 17-465 or B.F. No. 85-75 vapor barrier adhesive. Insulate valves and fittings as follows:

Insulate exposed and concealed valves and fittings with 2" thick glass fiberglass inserts or blankets. Cover fittings with Zeston Products PVC fitting covers or approved equal. PVC fitting covers shall be secured with mechanical fasteners such as tacks or staples for temperatures above 75 degrees F. For cold service all joints shall be sealed with vapor barrier adhesive or by pressure sensitive vapor barrier vinyl tape.

2.5. INSULATION MATERIALS AND APPLICATION METHODS (EQUIPMENT)

Equipment insulation materials and application methods shall be as follows:

2.5.1. TYPE 2

Insulation for cold surface equipment insulation shall be by Owens-Corning Fiberglass, Schuller, or Knauf for external surfaces with +40 degrees F to +220 degrees F operating temperature range shall be pipe or sheet insulation as required with 5.5 or 6.0 lb. density. Average thermal conductivity shall not exceed .27 BTU/HR at 75 F mean temperature. Apply insulation directly to metal surfaces and seal insulation joints. Insulation shall be mitered, beveled and built-up as required to provide a smooth and neat exterior surface. On large pumps and equipment provide joints in insulation at points where equipment casing must be disassembled for maintenance and repair. Insulate these joint areas so that insulation can be easily removed from casing joints without removing or damaging adjacent insulation. Finish insulation with two coats of vinyl-lacquer finish.

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2.6. INSULATION MATERIALS AND APPLICATIONS METHODS (HANGERS, SUPPORTS, ANCHORS, GUIDES, EXPANSION JOINTS, ETC.)

Insulation materials and application methods for piping hangers supports, anchors, guides expansion joints, etc., shall be as follows:

Insulate hangers and supports from direct contact with cold or hot surfaces (-120°F to 450°F) with "Buckaroos Inc." or approved equal pipe insulation support system.

The length of the "Buckaroo" insulation support same as the pipe insulation thickness. Provide ASJ type discs to reestablish vapor barrier.

2.7. INSULATION SCHEDULE

INSULATION SERVICE	SIZE	TYPE	THICKNESS	JACKET
Chilled Water	½" thru 1-1/2"	1	1"	ASJ
Chilled Water	2" and up	1	1-1/2"	ASJ
Domestic Cold Water	½" thru 1-1/4"	1	½"	ASJ
Domestic Cold Water	1-1/2" and up	1	1"	ASJ
Domestic Hot Water	½" thru 1"	1	½"	ASJ
Domestic Hot Water	1-1/4" and up	1	1"	ASJ
Drinking Fount. Drain	All Sizes	1	1"	ASJ
Hot Water	½" thru 1-1/2"	1	1"	ASJ
Hot Water	2" and Up	1	1-1/2"	ASJ
Condensate Drain	All Sizes	1	½"	ASJ
*Refrigerant Suction	All Sizes	1	1"	ASJ
Roof Drain	All Sizes	1	½"	ASJ
Strainers	--	2	½"	--
Air Separators	--	2	½"	--
Expansion Tanks	--	2	½"	--
Chilled Water Tanks	--	2	½"	--
Steam and condensate return	½" up to 1-1/2"	1	1"	ASJ
Steam and condensate return	2" up to 12"	1	1-1/2"	ASJ

*Provide a minimum of .016" thick aluminum jacket with band clamps and aluminum fitting covers over all pipe insulation located on the exterior of the building.

3. PART 3 - EXECUTION

3.1. PIPING INSTALLATION

Piping systems materials and installation shall conform to the following standards and codes.

System: Heating and Air Conditioning Piping

Code: ANSI Standard B31.1.0 "Power Piping"

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System: Natural Gas Piping
Code: ANSI Standard B31.12 "Fuel Gas Piping"
System: Plumbing System Piping
Code: International Association of Plumbing & Mechanical Official's "Uniform Plumbing Code"

No piping containing water shall be located in areas subject to freezing temperatures, including: unheated attics, unheated plenums, chases wall spaces or cavities within exterior walls, under slabs, or in concrete.

Pipe sizes indicated on plans and as specified refer to nominal size in inches, unless otherwise indicated. Pipes are sized to nearest $\frac{1}{2}$ ". In no case shall piping smaller than size specified be used.

Contractor shall provide and be responsible for proper location of pipe sleeves, hangers, supports, and inserts. Install hangers, supports, inserts, etc., as recommended by manufacturer and as specified and detailed on drawings.

Verify construction types and provide proper hangers, inserts and supports for construction used. Install inserts, hangers and supports in accordance with manufacturers load ratings and provide for thermal expansion of piping without exceeding allowable stress on piping or supports. Provide solid type hangers and supports where pipe travel exceeds manufacturer's recommendations for fixed hanger and supports.

Install piping parallel with building lines and parallel with other piping to obtain a neat and orderly appearance of piping system. Secure piping with approved anchors and provide guides where required to insure proper direction of piping expansion. Piping shall be installed so that allowable stress for piping, valves and fittings used are not exceeded during normal operation or testing of piping system.

Install piping so that systems can be completely drained. Provide piping systems with valve drain connections at all low pipe and ahead of all sectionalizing valves whether shown on plans or not. Drain lines shall be $\frac{3}{4}$ ".

Drain valves on closed piping systems such as chilled water system shall have lock shields and plugged or capped outlets to protect system from inadvertent drainage.

Pitch all piping and where possible make connections from horizontal piping so that air can be properly vented from system. Provide air vents as specified at all system high points and at drop in piping in direction of flow. Use eccentric reducers where necessary to avoid air pockets in horizontal piping.

Provide unions or flanged joints in each pipe line preceding connections to equipment to allow removal for repair or replacement. Provide all screwed and control valves with unions adjacent to each piping connection. Provide screwed end valves with union adjacent to valve unless valve can be otherwise easily removed from line.

Fittings pressures and temperature ratings shall be equal to or exceed maximum operating temperature and working pressure of piping system. No mitered or field fabricated pipe fittings will be permitted.

All pipe threads shall meet ANSI Standard B2.1 for taper pipe threads. Lubricate pipe threads with Teflon thread sealant and lubricating compound applied full strength. Powdered or made-up compound will not be permitted. Pipe thread compound shall be applied only to male pipe threads.

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Brazed socket type joints shall be made with suitable brazing alloys. Minimum socket depth shall be sufficient for intended service. Brazing alloy shall be end fed into socket, and shall fill completely annular clearance between socket and pipe or tube. Brazed joints depending solely upon a fillet rather than a socket type joint will not be acceptable.

Soft soldered socket type joints shall be made with sill-floss or 95-5 tin-antimony solder as required by temperature and pressure rating of piping system. Soldered socket-type joints shall be limited to systems containing non-flammable and non-toxic fluids. Soldered socket-type joints shall not be used on piping systems subject to shock vibration. Soldered joints depending solely upon a fillet rather than a socket-type joint will not be acceptable.

Make changes in piping size and direction with approved factory made fittings. Provide fittings suitable for at least 125 PSI working pressure or of pressure rating required for maximum working pressure of system whichever is greater.

3.2. PIPING SUPPORTS, ANCHORS, SLEEVES AND SEALS

Furnish proper type and size pipe sleeves to General Contractor for installation in concrete or masonry walls or floors. Sleeves are not required for supply and waste piping through wall supporting plumbing fixtures or for cast iron soil pipe passing through concrete slab or grade except where penetrating a membrane waterproof floor.

Mechanical Contractor shall supervise installation of sleeves to insure proper location and installation.

Each sleeve shall be continuous through wall floor or roof and shall be cut flush on each side except where indicated otherwise. Sleeves shall not be installed in structural member except where indicated or approved.

Sleeves passing through above grade floors subject to flooding such as toilet rooms, bathrooms, equipment rooms and kitchens shall be cast iron with integral flanges and shall extend 1 inch above finished floor. Size sleeves for and seal space between pipe sleeve with Thunderline Link-Seal.

Provide steel pipe sleeves in bearing walls and masonry walls. Opening in non-bearing walls, floors and ceilings may be 20 gauge galvanized pipe sleeves or openings cut with concrete core drill.

Pipe insulation shall run continuous through pipe sleeves with 1/4" minimum clearance between insulation and pipe sleeve. Provide metal jackets over insulated pipes passing through fire walls, floors and smoke partitions. Jacket shall be 0.018 stainless steel extending 12 inches on either side of barrier and secured to insulation with 3/8" wide band. Seal annular space between jacket and pipe sleeves with Thunderline High Temperature Link Seal.

Pipe wall penetrations exposed to view shall have tight fitting escutcheons or flanges to cover all voids around openings.

All below grade and exterior wall penetrations shall be installed in a pipe sleeve and sealed between the pipe and pipe sleeve with Thunderline High Temperature Link Seal.

Provide sleeves through all fire-rated walls and fill voids surrounding sleeves and interior to sleeves around cables with Nelson "Flameseal" fire stop putty with U.L. listed 3 hour rating installed as per manufacturers recommendations.

Equivalent by Dow, Chemelex, 3M.

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3.3. PIPE HANGERS AND SUPPORTS

Provide and be responsible for locations of piping hangers, supports and inserts, etc., required for installation of piping under this contract. Design of hangers and supports shall conform to current issue of Manufacturers Standardization Society Specification (MSS) SP-58.

Pipe hangers shall be capable of supporting piping in all conditions of operation. They shall allow free expansion and contraction of piping, and prevent excessive stress resulting from transferred weight being induced into pipe or connected equipment. Support horizontal or vertical pipes at locations of least vertical movement.

Where horizontal piping movements are such that hanger rod angularity from vertical is greater than 4 degrees from cold to hot position of pipe, offset hanger, pipe, and structural attachments to that rod is vertical in hot position.

Hangers shall not become disengaged by movements of supported pipe.

Provide sufficient hangers to adequately support piping system at specified spacing, at changes in piping direction and at concentrated loads. Hangers shall provide for vertical adjustment to maintain pitch required for proper drainage, and for longitudinal travel due to expansion and contraction of piping. Fasten hangers to building structural members wherever practicable.

Unless indicated otherwise on drawings support horizontal steel piping as follows:

PIPE SIZE	ROD DIAMETER	MAXIMUM SPACING
Up to 1-1/4"	3/8"	8 Ft.
1-1/2" to 2"	3/8"	10 Ft.
2-1/2" to 3-1/2"	1/2"	12 Ft.
4" and 5"	5/8"	15 Ft.

Unless indicated otherwise on drawings support horizontal copper tubing as follows:

NOM. TUBING SIZE	ROD DIAMETER	MAXIMUM SPACING
Up to 1"	3/8"	6 Ft.
1-1/4" to 1-1/2"	3/8"	8 Ft.
2"	3/8"	9 Ft.
2-1/2"	1/2"	9 Ft.
3" and 4"	1/2"	10 Ft.

Support horizontal cast iron soil pipe with two hangers for each section located close to each hub.

Support vertical cast iron soil pipe at every floor, steel and copper tubing at every other floor except where indicated otherwise on drawings.

Provide continuous threaded hanger rods wherever possible. No chain, wire, or perforated straps shall be used.

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Hanger rods shall be subject to tensile loading only, where lateral or axial pipe movement occurs provide suitable linkage to permit swing. Provide pipe support channels with galvanized finish for concealed locations and painted finish for exposed locations. Submit design for multiple pipe supports indicating pipe sizes, service and support detail to Architect-Engineer for review prior to fabrication.

Provide Grinnell pipe hangers for vertical pipe risers as follows:

PIPE MATERIAL	PIPE SIZE	HANGER FIG. NO.
Copper	½" thru 4"	CT-121
Steel	¾" thru 20"	261

Provide Grinnell Fig. 194, 195 or 199 steel wall brackets for piping suspended or supported from walls. Brackets shall be prime coated carbon steel.

Mount hangers for insulated piping on outside of pipe insulation sized to allow for full thickness of pipe insulation.

Provide Grinnell Fig. 167 insulation protection shields sized so that line compressive load does not exceed one-third of insulation compressive strength. Shield shall be galvanized steel and support lower 180 degrees of pipe insulation on copper tubing. Provide wood block at each pipe hanger in thickness of insulation. Insulation vapor barrier jacket shall overlap wood block to maintain vapor barrier.

Structural attachments for pipe hangers shall be as follows:

Concrete Structure: Provide Grinnell Fig. No. 285 cast in concrete insert for loads up to 400 lbs. and Grinnell Fig. 281 wedge cast in type concrete insert for loads up to 1200 lbs.

Provide Grinnell pipe hangers for horizontal single pipe runs as follows:

PIPE MATERIALS	PIPE SIZE	HANGER FIG. NO.
Copper	½" thru 4"	CT-65
Steel	3/8" thru 4"	65
Steel	5" thru 30"	260

Provide Fee and Mason Fig. 600 channel trapeze pipe hangers for horizontal multiple pipe runs with pipe clamps or pipe rollers as follows:

PIPE MATERIALS	PIPE SIZE	CLAMP NO.	ROLLER NO.
Copper	3/8" thru 4"	8600 CP*	8010 CP*
Steel	3/8" thru 6"	8500	8010

*Copper Plated

Pipe supports for horizontal piping mounted on pipe racks or stanchions shall be Advanced Thermal Systems low friction graphite slide supports or equivalent by Elcen or Grinnell. Where racks and supports are not detailed on drawings submit detailed support drawings to Architect-Engineer for review prior to fabrication.

Provide Fee and Mason Fig. 404 vibration control hangers at locations where piping vibrations would be transmitted to building structure by conventional hangers. Apply hangers within their load supporting range.

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Provide Elcen Fig. 50 pipe saddle with adjuster to support piping from floor. Provide complete with pedestal type floor stand.

Provide necessary structural steel and attachment accessories for installations of pipe hangers and supports. Where heavy piping loads are to be attached to building structure verify structural loading with Architect-Engineer prior to installations.

Equivalent hangers and supports by Auto-Grip, Basic Engineer, Bee Line, Elcen, Fee & Mason, Fluorocarbon Company, Unistrut or Super Strut Inc.

Provide polycarbonate pipe support for piping located on flat roofs, unless otherwise indicated on drawings. Support will be of modular stackable design with a nylon roller bearing directly supporting pipe and a preformed saddle to keep piping on roller bearing. Maximum pipe support spacing shall be 10'. Provide pipe supports from Miro Industries, or approved equivalent, in the following sizes:

PIPE SIZE	MODEL NUMBER
Up to 3"	3-R-2
3 1/2" thru 5"	5R

3.4. PAINTING OF ALL EXTERIOR PIPING AND SUPPORTS

Paint all exterior piping with (2) two coats of enamel rust inhibiting exterior paint (1) coat primer, (1) coat finish, in a color selected by architect. Plumbing contractor responsible for painting or coordinating this painting with General Contractor prior to bid.

See attached piping schedule

END OF SECTION 221000

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PIPING MATERIAL SCHEDULE

PIPING							FITTINGS		MAXIMUM WORKING	NORMAL	FIELD TEST	
SYSTEM	SIZE	TYPE	SCHED.	GRADE	ASTM	MATERIAL	MATERIAL	TYPE	PRESS.	TEMP.	PRESSURE	TIME
Boiler Relief	1/2"-2"	SL	--	--	A-106	CS	CI	T	0	400	--	--
Boiler Relief	2-1/2" & Up	ERW	--	--	A-53	CS	CS	W	0	40 to 80	--	--
Building Sewer	4"-8"	BS	40	--	A-74	CI	CI	NG	--	75	10'	1/2 hr.
Building Sewer	4"-8"	S	40	--	D-2665-88	PVC	PVC	SW	--	75	10'	1/2 hr.
Chilled Water	1/2"-2"	SL	--	--	A-106	CS	CI	T	85	40 to 90	125	1 hr.
Chilled Water	1/2"-2"	L	--	--	B-88	CP	CP	SJ	85	40 to 90	125	1 hr.
Chilled Water	2 1/2"-6"	L	--	--	B-88	CP	CP	V	85	40 to 90	125	1 hr.
Chilled Water	2-1/2"-8"	ERW	40	--	A-53	CS	CS	W	85	40 to 90	125	1 hr.
Dom. H.W. & H.W. Return	1/2"-6"	L	--	--	B-88	CP	CP	SJ	85	100 to 140	130 lb.	1/2 hr.
Domestic Cold Water	1/2"-6"	L	--	--	B-88	CP	CP	SJ	85	40 to 55	130 lb.	1/2 hr.
Domestic Hot and Cold Below Grade	1/2"-6"	K	--	--	B-88	CP	CP	SS	85	40 to 55	120	1/2 hr.
Drain Line	All	M	--	--	B-88	CP	CP	SJ	0	40 to 80	--	--
Hot Water	1/2"-2"	SL	--	--	A-106	CS	CI	T	85	180	125	1 hr.
Hot Water	1/2"-2"	L	--	--	B-88	CP	CP	SJ	85	180	125	1 hr.
Hot Water	2 1/2"-6"	L	--	--	B-88	CP	CP	V	85	45 to 190	125	1 hr.
Hot Water	2-1/2"-6"	ERW	40	--	A-53	CS	CS	W	50	180	125	1 hr.
Natural Gas	2-1/2" & Up	ERW	40	--	A-53	CS	CS	W	5	55 to 85	75 lb.	1 hr.
Natural Gas	1/2"-2"	SL	40	--	A-106	CS	MI	T	5	55 to 85	75 lb.	1/2 hr.
Natural Gas Below Grade	All	PE	SDR- 11	--	D-1248	PE	PE	F	30	60	100	1 hr.
Refrigerant Lines	All	ACR			B-88	CP	CP	SS	225	30 to 125		See Div. 15
Roof Drain Above Grade	4"-12"	NH	SV	--	A-74	CI	CI	NH	--	75	10'	1/2 hr.
Roof Drain Above Grade	4"-12"	S	40	--	D-2665-88	PVC	PVC	SW	--	75	10'	1/2 hr.
Roof Drain Below Grade	4"-16"	BS	40	--	A-74	CI	CI	BS	--	75	10'	1/2 hr.
Roof Drain Below Grade	4"-16"	S	40	--	D-2665-88	PVC	PVC	SW	--	75	10'	1/2 hr.
Soil & Waste Above Grade	1-1/2"-6"	NH	SV	--	A-74	CI	CI	NH	--	75	10'	1/2 hr.
Soil & Waste Above Grade	2"-4"	S	40	--	D-2665-88	PVC	PVC	SW	--	75	10'	1/2 hr.

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Soil & Waste Below Grade	2"-6"	NH	40	--	A-74	CI	CI	NH	--	75	10'	1/2 hr.
Soil & Waste Below Grade	2"-4"	S	40	--	D-2665-88	PVC	PVC	SW	--	75	10'	1/2 hr.
Chemical Waste and Vent Above Grade	All	PP	40	--	D-635/D-2447	PP	PP	MECH	--	75	10'	1/2 hr.
Chemical Waste and Vent Below Grade	All	PP	40	--	D-635/D-2447	PP	PP	F	--	75	10'	1/2 hr.
Steam	1 1/2"-2"	SL	40	--	A-106	CS/BLK	CS	T	120	350	200	1 hr.
Steam	2 1/2"-8"	ERW	40	--	A-53	CS/BLK	CS	W	120	350	200	1 hr.
Condensate Return	1/2"-2"	SL	80	--	A-106	CS/BLK	CI	T	20	230	75	1 hr.
Condensate Return	2 1/2"-4"	ERW	80	--	A-53	CS/BLK	CS	W	20	230	75	1 hr.
Feed Water Piping	1/2"-2 1/2"	SL	40	--	A-106	CS	CI	T	85	140	130	1 hr.
Fuel Oil Piping	1/2"-2 1/2"	SL	40	--	A-106	CS	CI	T	85	150	130	1 hr.
Compressed Air Piping	1/2"-2 1/2"	SL	40	--	A-106	CS	CI	T	125	125	150	1 hr.
Fire Service Below Grade	4"-10"	DI	--	--	A377-66	DI	DI	MECH	85	40 to 55	130 lb.	1/2 hr.
Domestic Water Service Below Grade	4"-8"	DI	--	--	A377-66	DI	DI	MECH	85	40 to 55	130 lb.	1/2 hr.

ABBREVIATIONS:

BLK - Black

BS - Bell & Spigot

CI - Cast Iron

CP - Copper

CS - Carbon Steel

DI - Ductile Iron

ERW - Electric Resistant Weld

F - Fusion Weld

GLV - Galvanized

MECH - Mechanical

MI - Malleable Iron

MJ - Mechanical Joint

NG - Neoprene
Gasket

NH - No Hub

PVC - Polyvinyl
ChloridePC - Rolled Grooved Pipe
Coupling

PE - Polyethylene

PP - Polypropylene

S - Socket Joint

SJ - Solder Joint 95-5
antimony

SL - Seamless

SS - Silver Solder

SV - Service Weight

SW - Solvent Weld

Tin- T - Threaded

W - Welded

V - Victaulic

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SECTION 221500 - PIPING SPECIALTIES

1. PART 1 - GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2. PART 2 – PRODUCTS

2.1. INSULATING UNIONS AND FLANGES

Provide insulating unions and flanges conforming to following specifications and plainly and permanently marked with manufacturers name and pressure class rating. Unions and flanges shall be as follows:

2.1.1. Steel pipe to steel pipe screwed end:

Provide Stockham malleable iron No. 693-1/2 insulating union with high dielectric strength insulating sleeve and gasket.

2.1.2. Steel pipe to steel pipe flanged end:

Provide two weld neck flanges of proper pressure rating insulated on both sides with Central or Klingerit Flange Insulation Kit.

2.1.3. Iron or steel pipe to copper pipe:

Provide Epco Dielectric union or flange with screwed or solder joint as required. Union shall have 250 PSI rating and flange 175 PSI rating at 190 degrees F.

2.2. UNIONS

Provide unions or flanged joint in each line preceding connections to equipment or valves requiring maintenance.

Provide Stockham brass seat unions of material and pressure rating required by piping system.

Where piping systems of dissimilar materials are jointed together provide proper insulating union as specified under this specification.

Equivalent unions by Fairbanks or Grinnell.

2.3. STRAINERS

Install strainers upstream from automatic control valves, steam traps and pumps. Where strainers are an integral part of these items or incorporated in accessory equipment directly upstream, individual line strainers will not be required. Strainers shall be same size as piping. Provide strainers with proper isolation and blow down valves to allow basket removal for cleaning.

General: Provide Zurn "Y" type self-cleaning strainers with FIPT blow-off outlet, flanged or screwed end with pressure rating as required by piping system. Provide strainers with removable stainless steel screens with perforations as follows:

Service	¼" to 2"	2-1/2" to 8"
Air	.0027"	.005"
Fuel Oil	.005	1/16"
Water	.005	1/16"

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Equivalent strainers by Armstrong, Dunham Bush, Musseco, Trane, Paget or Yarway.

2.4. GAS PRESSURE REGULATORS

Provide gas pressure regulators with internal relief and low pressure cut-off as manufactured by Fisher Controls or Equimeter. Units shall be of size capable of capacities and pressures as shown on plans. Verify capacities and pressures with each piece of equipment served.

2.5. TRIPLE DUTY VALVES

Provide Bell & Gossett in-line triple duty valves in locations shown on plans. Valves shall be capable of providing flow balancing, flow check and positive shut-off. Valve shall have memory bank valve plug.

Equivalent valve by Armstrong, Taco, Amtrol, Mueller.

2.6. MANUAL AIR VENTS

Provide air vents at all high points of chilled and hot water systems of each water coil, drop in pipe against flow of water and where indicated on plans or required by job conditions.

Air vents shall be 1/4" copper drain line with a 1/4" Marsh tee handle cock in air vent line located in an accessible unfinished area. Where air vent above ceilings cannot be made accessible to an exposed location, a 12 x 12 access panel shall be provided at drain cock.

Equivalent air vents by Taco, Bell & Gossett.

2.7. BACKFLOW PREVENTERS

Provide where shown on plans the following types of backflow preventers. Provide isolation valve ahead of backflow preventers.

Equivalent backflow prevents by Febco, Lawler.

2.7.1. Double Check Valve (1/2"-2"):

Watts Series 007 double check valve assembly complete with ball type test cocks, full port ball valve shut offs and strainer.

2.7.2. Double Check Valve (2-1/2"-10"):

Watts Series 707 double check valve assembly complete with ball type test cocks, OS&Y valve shut offs and strainer. Epoxy coated cast iron check valve bodies with bronze seats.

2.7.3. Hose Bibb Vacuum Breakers

Vacuum Breakers for hose end connections shall be Watts Series 8 non removable type.

2.8. GAUGES

Gauges shall be bourdon tube with minimum 4-1/2" dial and die cast aluminum case with black enamel finish. The movement shall be all stainless steel with Grade A phosphor bronze bourdon tube brazed at socket and tip. The accuracy of the gauge shall be within 1/2 percent of the scale range. The pointer shall be the micrometer adjustment type recalibrated from the front. Pressure, compound, and differential pressure gauges shall have suitable scale ranges, shall be submitted and are subject to the review of the Engineer. Graduations shall be one pound or less on all gauges where this is standard for the required range.

Gauges shall have 1/4" IPS connections and shall be Moeller "Vantage" gauges with Case Style No. 2, or approved equal. If it complies with these specifications, equipment manufactured by one of the following manufacturers will be acceptable: Ashcroft, Marsh, Terice, Moeller, Weksler, Taylor, Weiss, or Midwest.

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Install a Sisco ¼" or ½" NPT fitting (Test Plug) of solid brass at desired indicated locations. Test plug shall be capable of receiving either a pressure or temperature probe 1/8" o.d. Dual seal core shall be neoprene for temperature to 200°F and shall be rated zero leakage from vacuum to 1000 psig.

Contractor shall also furnish the following: (2) two 2 ½" test gauges with appropriate adapters for test plugs, (2) two 5" stem pocket testing thermometers for 0° to 125°F range and (2) two for 0° to 220°F range.

Install gauges vertically.

3. PART 3 - EXECUTION

3.1. INSTALLATION

Thermometers shall be installed as hereinafter specified. Where thermometer is scheduled, a thermometer well shall be provided. All thermometer wells shall be constructed of brass or stainless steel and where installed in insulated piping shall have at least 2-1/2" lagging extension. Gauges shall be installed as hereinafter specified. Gauge cocks shall be polished brass A10 ¼" tee handle type with threaded ends. 125 psi rated. Provide gauge cock with ¼" pipe nipple for connection to gauge cock.

Pressure temperature ratings of each well shall be suitable for the system in which it is installed in accordance with specifications and as indicated on the drawings. All wells shall be filled with Silicon and be complete with caps and chains.

Thermometers shall have the temperature ranges as required for the intended application and shall be installed as scheduled.

3.2. THERMOMETER & TEST GAUGE COCK INSTALLATION SCHEDULE

SERVICE	Thermomet er & Well	Press Gauge & Gauge Cock	Pete's Plug
Hot water entering and leaving boiler	X	X	
Hot water entering and leaving each VAV box coil			X
Suction and discharge flange of each pump			X
Chilled water leaving each chiller	X		X
Hot water and chilled water entering and leaving coils in AHU	X		X
Supply air, return air, outside air at AHU	X		

3.3. WELDING

Contractor shall be responsible for quality of welding and suitability of welding procedures. All welding shall be in accordance with American Welding Society Standard B3.0 and ANSI Standard B31.1.

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Welded pipe joints shall be made by certified welding procedures and welders. Welding electrodes shall be type and material recommended by electrode manufacturer for materials to be welded. All pipe and fittings ends shall be beveled a minimum of 30 degrees prior to welding.

Only welders who have successfully passed welder qualifications tests in previous 12 months for type of welding required shall do welding. Each welder shall identify his work with a code marking before starting any welded pipe fabrication. Contractor shall submit three copies of a list of welders who will work on project listing welders' code, date and types of latest qualification test passed by each welder.

Welded joints shall be fusion welded in accordance with Level AR3 of American Welding Society Standard AWS D10.9 "Standard for Qualification of Welding Procedures and Welders for Pipe and Tubing". Welders qualified under National Certified Pipe Welding Bureau will be acceptable.

Bevel all piping and fittings in accordance with recognized standards by flame cutting or mechanical means. Align and position parts so that branches and fittings are set true. Make changes in direction of piping systems with factory made welding fittings. Make branch connections with welding tees or forged weldolets.

END OF SECTION 221500

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SECTION 221800 - VALVES

1. PART 1 - GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. EQUIVALENTS

Equivalent valves shall be used only from the following specified valve manufacturers and listed on current comparison charts by Apollo, Hammond, Hays, Milwaukee, Muessco, Nibco, Rockwell-Nordstrom, Stockham, and Watts.

2. PART 2 – PRODUCTS

2.1. VALVES

2.1.1. BALL VALVES

Ball valves shall be scheduled as type “BLV” valves. Valve specifications by type number shall be as follows:

Provide ball handle with extension or offset as required to clear piping insulation.

BLV-1: 2-1/2” valves and smaller, Hammond #8501 (screwed) or 8511 (solder) series bronze two piece large port ball valve 600 PSI-WOG/150 PSI-WSP reinforced TFE seats, chrome plate brass ball (tunnel or drilled design), silicon bronze stem vinyl-covered steel lever handle. Stainless steel ball and stem shall be provided for steam applications.

BLV-2: Ball valve shall be flexible lip seat to assure positive shut off (in both directions) and self compensates for wear. Material - fiberglass reinforced teflon, single piece. Self-adjusting, low friction teflon box ring stem seals pre-loaded by Belleville washers. Two-piece carbon steel body. Four bolt design with locking fasteners for vibration resistance and joint integrity, one piece teflon body seal. Valve shall be rated for 250 PSI steam service. 316 stainless steel ball and stem. Provide with insulated handle. Neles Jamesbury Model 21-2236MT. Equivalent by Worchester. MCF Series 56-HT.

2.1.2. GLOBE VALVES

Globe valves shall be scheduled as type “GLV” valves. Valve specifications by type number shall be as follows:

GLV-1: 2-1/2” valves and smaller, Hammond #IB413T (screwed) or IB423 (solder) bronze globe valve, 300 PSI-WOG/150 PSI-WSP union bonnet, Teflon disc, malleable iron handwheel.

2.1.3. PLUG VALVES

Plug valves shall be scheduled as type “PLV” valves. Valve specifications by type number shall be as follows:

PLV-1: 1” valves and smaller Hays 7400 series iron body gas cock, 175 PSI-WOG bronze plug washer and nut, screwed ends.

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PLV-2: 1-1/4" through 4" valves, Rockwell-Nordstrom Fig. 142, semi-steel lubricated plug valve, 175 PSI-WOG coated plug, two bolt cover, and short pattern screwed ends. Provide complete with standard pattern cast handle.

2.1.4. GATE VALVES

Gate valves shall be scheduled as type "GTV" valves. Valve specifications by type number shall be as follows:

GTV-1: 2" and smaller Hammond #IB640 (screwed) or IB635 (solder) ASTM B 62 bronze body and bonnet with malleable iron handwheel, 200 PSI-WOG/125 PSI-WSP.

GTV-2: 2 1/2" and larger Hammond #IR1140 HI, flanged, bolted bonnet, O.S. & Y., ASTM 126 iron body, bronze trimmed, 200 PSI-WOG/125 PSI-WSP.

2.1.5. CHECK VALVES

Check valves shall be scheduled as type "SCV" valves. Valve specifications by type number shall be as follows:

SCV-1: 2" valves and smaller Hammond #IB940 (screwed) or IB912 (solder) bronze check valve, 200 PSI-WOG/125 PSI-WSP, Teflon or bronze disc and seat ring.

SCV-2: 2-1/2" and larger Hammond #IR1124 HI flanged, ASTM 126 iron body, bronze trimmed, 200PSI-WOG/125 PSI-WSP.

2.1.6. BUTTERFLY VALVES

Butterfly valves shall be scheduled as Type "BFV" valves. Valve specifications by type number shall be as follows:

BFV-1: Size 3" and larger Hammond #6211-01 (lever) or 6211-03 (gear) ASTM A 126 cast iron drilled and tapped full lug body, 200 PSI-WOG 12" and smaller, 150 PSI-WOG 14" and larger, extended neck, bronze disc, stainless steel stem, field-replaceable EPDM or (buna for oil or lubricated service) sleeve and stem seals.

BFV-2: Butterfly valves shall be installed as stop valves in locations indicated on drawings in lines 2-1/2" through 8".

Butterfly valve shall be flexible lip seat to assure positive shut off (in both directions) and self compensates for wear.

Materials – fiberglass reinforced teflon, single piece. Eccentric disc and offset shaft to prevent pivoting on seat and reduce wear. One piece single diameter shaft. Material – 316 stainless steel.

Positive shaft retention. Chevron teflon packing. Body insert to protect seat from abrasion and erosion. Insert also allows for seat removal without disassembly of shaft and disc. Pinning of shaft to disc to minimize shear stress and prevent through leakage. Stainless backed teflon shaft bearings to provide high corrosion resistance and are self lubricating. No metal-to-metal moving parts. Full lug type body rated for ANSI Class 150. Material – carbon steel. Provide with fully enclosed gear operator, factory lubricated with pointer. Neles Jamesbury Model 815L-11-2136MT. Equivalent by Posiseal. Watts Model QF.

2.2. VALVE SCHEDULE

SYSTEM	SIZE	STOP	CHECK	BALANCE
Domestic Water	1/2"-2-1/2"	BLV-1	SCV-1	--

Natural Gas	½" - 1"	PLV-1	--	--
Natural Gas	1-1/4"-4"	PLV-2	--	--
Hot Water	½" - 2-1/2"	BLV-1	SCV-1	BAV-1
Hot Water	3"-6"	BFV-1	SCV-2	BAV-1
Chilled Water	½" - 2-1/2"	BLV-1	SCV-1	BAV-1
Chilled Water	3"-8"	BFV-1	SCV-2	BAV-1
Steam	½"-2"	GTV-1	SCV-1	--
Steam	2-1/2" and up	GTV-2	SCV-2	--
Pumped Condensate	½"-1-1/2"	--	SCV-1	--
Compressed Air	All	BLV-1	--	--

3. PART 3 - EXECUTION

3.1. INSTALLATION

Install necessary valves within piping systems to provide required flow control, to allow isolation for inspection, maintenance and repair of each piece of equipment or fixture, and on each main and branch service loop.

Each valve shall be installed so that it is easily accessible for operation, visual inspection, and maintenance and wherever possible, gate, check and ball valves shall be installed on a horizontal run with the handle upright and within 15 degrees of vertical. Butterfly valves shall be installed with the stem in the horizontal position and the handle at 90 degrees from vertical.

Valves installed in piping systems shall be compatible with system maximum test pressure, pipe materials, pipe joining method, and fluid or gas conveyed in system.

Valves 2-1/2" and smaller shall have soldered or screwed end connections as required by piping materials unless otherwise specified or shown on drawings. Install union connection in the line within two feet of each screw end valve unless valve can be otherwise easily removed from line. Valves 3" and over shall have flange end connections.

Non-rising stem valves shall not be installed at any point in the piping systems. With permission of Architect-Engineer non-rising stem valve may be installed at particular points where space is restricted.

Provide butterfly valves 6" and smaller with 10 position lever handle for on-off application and infinite position handle for throttling applications. Provide butterfly valves 8" and up with fully enclosed all weather gear operators.

Install globe valves with pressure on top of disc except that must be completely drained for inspection, maintenance or to prevent freezing shall be installed with stem in horizontal position to insure complete drainage of pipelines.

Gate valves shall not be installed in pipelines where intended for throttling service or where piping is subject to vibration as part of normal operating conditions.

Valves shall be designed for repacking under pressure when fully opened and backseated.

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Balancing valves installed by means of sweating or soldering shall have their interiors removed before installation and reinstalled upon dissipation of the heat associated with installation. Using a wet rag in lieu of removing the valve interior as a means of heat dissipation during installation is not acceptable.

END OF SECTION 221800

SECTION 224000 - PLUMBING FIXTURES AND EQUIPMENT

1. PART 1 - GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. ELECTRICAL WORK REQUIRED

Contractor shall provide electrical connections for any equipment that requires electrical connections for power or control. Electrical requirements and work shall be coordinated with Electrical Contractor.

1.3. PIPING SYSTEMS

Refer to Section 221000 of this specification for piping material specifications and installation instructions. Specific piping materials and joining methods for systems installed under this section shall be as listed in schedule.

1.4. PIPING SYSTEMS VALVES

Refer to Section 221800 of this specification for valve type specifications and installation instructions.

1.5. PIPING SYSTEMS INSULATION

Refer to Section 221000 for insulation type specifications and installation instructions.

2. PART 2 – PRODUCTS

2.1. PLUMBING FIXTURES

Provide plumbing fixtures as shown on drawings and as specified complete including piping and connections. China fixtures shall be of best grade vitreous ware without pit holes or blemishes and outlines shall be generally true. Architect-Engineer reserves right to reject any piece, which in their opinion is faulty. Fixtures fitting against walls shall have ground backs. Exposed piping and fittings shall be chrome plated.

Set fixtures true and level with all necessary supports for fixtures installed before wall finish is done. Nipples through wall to fixture connections shall be chrome plated brass. Provide silicone sealer around perimeter of lavatories, water closets, and urinals at connection to wall and/or floor.

2.2. EQUIVALENTS

Equivalent fixtures and accessories by following manufacturers will be acceptable.

Fittings and Supports: Josam, Smith, Wade, or Zurn.

Traps, Supplies and Stops: Dearborn, Brass Craft, Central D, Sanitary Dash or as specified under plumbing fixtures.

Traps: Dearborn #FS510 (1-1/2") and/or EFS507 (1-1/4") cast brass body with clean-out and 17 gauge tube outlet "P" trap. Provide deep chrome plated brass escutcheon with set screw.

2.3. PLUMBING EQUIPMENT

2.3.1. FLOOR DRAINS

Drains shall be type and style listed below. Unless indicated otherwise provide each drain that does not have an integral "P" trap with a deep seal cast iron "P" trap in connecting piping.

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Equivalent drains by J.R. Smith, Zurn, Watts, or Josam.

2.3.1.1. Floor Drain Type 1

Wade #W-1100 floor drain, dura-coated cast iron body with bottom outlet, combination invertible membrane clamp and adjustable nickel bronze strainer. Strainer shall have a 6" round top.

2.3.1.2. Floor Drain Type 2

Wade #W-2350-9 8" square top medium duty drain, cast iron deep sump body with bottom outlet, seepage pan and combination membrane flashing clamp and frame for medium duty cast iron deep flange grate with secondary dome strainer less bucket. Cut grate to accept condensate drain where drain used for condensate drain receiver.

2.3.1.3. Floor Drain Type 3

Wade #W9110-15 or 16 8" x 8" cast iron floor sink, with white acid resisting epoxy body interior (A.R.E.). Nickel bronze strainers, loose set 1/2" or 3/4" grate, and aluminum interior dome strainer.

2.3.2. CLEANOUTS

Provide cleanout the full size of soil pipe served up to 4" I.D. Cleanouts for soil lines larger than 4" shall be 4". Provide cleanouts in base of soil pipe stacks, ends of sewer main, at changes in direction of over 45 degrees and in horizontal pipe runs exceeding 100 feet at 50 foot intervals.

Install cleanouts so they are accessible by extending them through walls, and floors, to outside of building, or to above grade as required.

Where exterior cleanouts do not occur in sidewalks, paved roadways, etc., provide a concrete pad 18" x 18" x 6" thick with top 1-1/2" above finished grade.

Floor (Concrete Floor Finish): Wade #W-6000-XS cast iron cleanout with square, heavy duty, scoriated nickel bronze top, adjustable above to finished floor.

Floor (Quarry Tile Floor Finish): Same as concrete floor finish.

Floor (Tile Floor Finish): Wade #W-6000-TS cast iron cleanout with square heavy duty nickel bronze top, recessed for tile and adjustable to finished floor.

Floor (Carpet Floor Finish): Wade #W-6000-XS-72 cast iron cleanout with round, heavy duty nickel bronze top with carpet retainer and adjustable to finished floor after concrete has set.

Wall: Wade #W-8450-C cleanout with dura-coated cast iron ferrule and cadmium plated cast iron counter-sunk plug complete with round smooth nickel bronze wall access cover and flush over-wall frame.

Verify floor materials used from Architectural plans and provide proper cleanout tops, where they occur in carpet, quarry tile, vinyl tile or ceramic tile.

Equivalent by J.R. Smith, Wade, Watts, or Josam.

2.3.3. WALL HYDRANTS

Wall hydrants shall be Josam series 71000 with connections for 3/4" pipe and hose. Non-freezing type with key, vacuum breaker, and locking cover.

Equivalent by J.R. Smith, Wade, Woodford, Watts, or Zurn.

2.3.4. GREASE INTERCEPTORS

Provide Wade W-5100 Series steel grease interceptor with acid resisting rubber base coating inside and outside, flow control fitting, removable baffles, threaded inlet and outlet, internal air

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relief, double wall trap with cleanout, gasketed scoriated cover, and PDI seal of approval. Units shall have a grease capacity as indicated on the drawings.

Equivalent by J.R. Smith, Wade, or Josam.

3. PART 3 - EXECUTION

All plumbing fixtures shall be cleaned and free of all construction debris. Electric water cooler shall be protected during construction. Any chrome trim with wrench marks shall be removed and new trim installed. Architect-Engineer reserves the right to reject any plumbing fixture.

See plans for Plumbing Fixture Schedule.

END OF SECTION 224000

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RELEASE FOR
CONSTRUCTION
AS NOTED ON PLANS REVIEW
DEVELOPMENT SERVICES
LEE'S SUMMIT, MISSOURI
Lee's Summit, MO
07/16/2020

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**RELEASE FOR
CONSTRUCTION
AS NOTED ON PLANS REVIEW
DEVELOPMENT SERVICES
LEE'S SUMMIT, MISSOURI
Lee's Summit, MO
07/16/2020**

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SECTION 230100 - HVAC PROVISIONS

1. PART 1 - GENERAL

1.1. RELATED DOCUMENTS

All contract documents including drawings, alternates, addenda and modifications and general provisions of the Contract, including General and Supplementary Conditions and all other Division Specification Sections, apply to work of this section. All preceding and following sections of this specification division are applicable to the Mechanical Contractor, all sub-contractors, and all material suppliers.

1.2. SCOPE OF WORK

This DIVISION requires the furnishing and installing of complete functioning Heating, Ventilating, and Air Conditioning systems, and each element thereof, as specified or indicated on Drawings or reasonably inferred, including every article, device or accessory reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the Work include materials, labor, supervision, supplies, equipment, transportation, and utilities.

Refer to Architectural, Structural, Mechanical, and Electrical Drawings and all other contract documents and to relevant equipment drawings and shop drawings to determine the extent of clear spaces and make all offsets required to clear equipment, beams and other structural members to facilitate concealing piping and ductwork in the manner anticipated in the design.

1.3. SPECIFICATION FORM AND DEFINITIONS

The Engineer indicated in these specifications is Pearson Kent McKinley Raaf Engineers LLC. 2933 SW Woodside Dr, Suite C, Topeka, KS, 66614, PHONE 785-273-2447, FAX 785-273-0456, EMAIL scott.mckinley@pkmreng.com.

Contractor, wherever used in these specifications, shall mean the Company that enters into contract with the Owner to perform this section of work.

When a word, such as "proper", "satisfactory", "equivalent", and "as directed", is used, it requires the Architect-Engineer's review. "Provide" means to furnish and install in a satisfactory working condition.

1.4. QUALIFICATIONS

The contractors responsible for work under this section shall have completed a job of similar scope and magnitude within the last 3 years. The contractors shall employ an experienced, competent and adequate work force licensed in their specific trade and properly supervised at all times. Unlicensed workers and general laborers shall be adequately supervised to insure competent and quality work and workmanship required by this contract and all other regulations, codes and practices. At all times the contractors shall comply with all applicable local, state and federal guidelines, practices and regulations. Contractor may be required to submit a statement of qualifications upon request before any final approval and selection. Failure to be able to comply with these requirements is suitable reason for rejection of a bid.

1.5. LOCAL CONDITIONS

The contractor shall visit the site and determine the existing local conditions affecting the work required. Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

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1.6. CONTRACT CHANGES

Changes or deviations from the contract documents; including those for extra or additional work must be submitted in writing for review of Architect-Engineer. No verbal change orders will be recognized.

1.7. LOCATIONS AND INTERFERENCES

Locations of equipment, piping and other mechanical work are indicated diagrammatically by the mechanical drawings. The Contractor shall determine the exact locations on site, subject to structural conditions, work of other Contractors, and access requirements for installation and maintenance to approval of Architect-Engineer. Provide additional piping and ductwork offsets as required at no additional cost.

Study and become familiar with the contract drawings of other trades and in particular the general construction plans and details in order to obtain necessary information for figuring installation.

Cooperate with other contractors and install work in such a way as to avoid interference with their work. Minor deviations, not affecting design characteristics, performance or space limitation may be permitted if reviewed prior to installation by Architect-Engineer.

Any pipe, ductwork, equipment, apparatus, appliance or other item interfering with proper placement of other work as indicated on drawings, specified, or required, shall be removed, relocated and reconnected without extra cost. Damage to other work caused by this Contractor, the Subcontractor, or workers shall be restored as specified for new work.

Do not scale mechanical and electrical drawings for dimensions. Contractor shall accurately layout work from the dimensions indicted on the Architectural drawings unless they are found to be in error.

1.8. PERFORMANCE

Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification division.

The Contractor warrants to the Owner and Architect-Engineer the quality of materials, equipment, workmanship and operation of equipment provided under this specification division for a period of one year from and after completion of building and acceptance of mechanical systems by Owner.

1.9. WARRANTY

The Contractor warrants to the Owner and Architect-Engineer that upon notice from them within a one year warranty period following date of acceptance, that all defects that have appeared in materials and/or workmanship, will be promptly corrected to original condition required by contract documents at Contractor's expense. The above warranty shall not supersede any separately stated warranty or other requirements required by law or by these specifications.

1.10. ALTERNATES

Refer to General Requirements for descriptions of any alternates that may be included.

1.11. MATERIALS, EQUIPMENT AND SUBSTITUTIONS

The intent of these specifications is to allow ample opportunity for Contractor to use his ingenuity and abilities to perform the work to his and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required. Material and equipment installed under this contract shall be first class quality, new, unused and without damage.

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In general, these specifications identify required materials and equipment by naming one or more manufacturer's brand, model, catalog number and/or other identification. The first named manufacturer or product is used as the basis for design; other manufacturers named must furnish products consistent with specifications of first named product as determined by Engineer. Base bid proposal shall be based only on materials and equipment by manufacturers named, except as hereinafter provided.

Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to Architect-Engineer for review prior to procurement.

Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color as determined by Architect-Engineer whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by two copies of complete descriptive and technical data including manufacturer's name, model and catalog number, photographs or cuts, physical dimensions, operating characteristics and any other information needed for comparison.

If the Contractor wishes to incorporate products other than those named in the Base Bid Specifications they shall submit a request for approval of equivalency in writing no later than (10) ten calendar days prior to bid date. Substitutions after this may be refused at Engineers option. Equivalents will ONLY be considered approved when listed by addendum.

In proposing a substitution prior to or subsequent to receipt of bids, include in such bid the cost of altering other elements of this project, including adjustments in mechanical or electrical service requirements necessary to accommodate such substitution.

Within 10 working days after bids are received, the apparent low bidder shall submit to the Architect-Engineer for approval, three copies of a list of all major items of equipment they intend to provide. Within 30 working days after award of Contract, Contractor shall submit shop drawings for equipment and materials to be incorporated in work, for Architect-Engineer review. Where 30-day limit is insufficient for preparation of detailed shop drawings on major equipment or assemblies, Contractor shall submit manufacturer's descriptive catalog data and indicate date such detailed shop drawings will be submitted along with manufacturer's certification that order was placed within 30 working day limit.

1.12. ELECTRONIC PLAN FILES

Electronic files of the contract documents may be available from the Engineer to successful bidders and manufacturers for a fee of \$50 per sheet, \$100 minimum and \$25 email/shipping charge. A release of liability form will be required along with payment prior to release of files.

1.13. TEMPORARY USE OF PERMANENT HVAC UNITS

If the Contractor elects to use permanent equipment for temporary conditioning only that permanent equipment associated with the heating system shall be allowed for use as space conditioning during the construction period. The Mechanical Contractor shall take full responsibility for all permanent equipment used for temporary conditioning during the construction period and shall provide a total of two years warranty covering all parts and labor on all permanent equipment utilized for temporary conditioning. This warranty shall cover all piping, fittings, valves, pipe and equipment insulation, pumps, boilers, chillers, condensing units, cooling towers, air handling units, exhaust and relief air fans, ductwork, ductwork insulation, diffusers, temperature controls, all electric motors, starters, disconnect switches, fuses, wire and conduit. This warranty shall cover all

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required maintenance on the system with the exception of filter changes, and shall start on the date shown on the final completion certificate.

CAUTION: The Contractor is being warned that the Architect-Engineer will not accept dirty equipment caused by construction contamination.

1.14. OPENINGS, ACCESS PANELS AND SLEEVES

This Contractor shall include the installation of all boxes, access panels and sleeves for openings required to install this work, except structural openings incorporated in the structural drawings. Sleeves shall be installed for all pipes passing through structural slabs and walls. Contractor shall set and verify the location of sleeves that pass through beams, as shown on structural plans. All floor and wall penetrations shall be sealed to meet fire-rating requirements.

1.15. ARCHITECTURAL VERIFICATION AND RELATED DOCUMENTS

Contractor shall consult all Architectural Drawings and specifications in their entirety incorporating and certifying all millwork, furniture, and equipment rough-in including utility characteristics such as voltage, phase, amperage, pipe sizes, duct sizes, including height, location and orientation. Shop drawings incorporating these requirements should be submitted to the Architect for approval prior to installation or rough in.

1.16. EXTENT OF CONTRACT WORK

Provide mechanical systems indicated on drawings, specified or reasonably implied. Provide every device and accessory necessary for proper operation and completion of mechanical systems. In no case will claims for "Extra Work" be allowed for work about which Contractor could have been informed before bids were taken.

Contractor shall become familiar with equipment provided by other contractors that require mechanical connections and controls.

Electrical work required to install and control mechanical equipment, which is not shown on plans or specified under Division 26, shall be included in Contractor's base bid proposal. All automatic temperature control devices shall be mounted as indicated in automatic temperature control section of specifications.

The cost of larger wiring, conduit, control and protective devices resulting from installation of equipment which was not used for basis of design as outlined in specifications shall be paid for by Mechanical Contractor at no cost to Owner or Architect-Engineer.

Contractor shall be responsible for providing supervision to Electrical Contractor to insure that required connections, interlocking and interconnection of mechanical and electrical equipment are made to attain intended control sequences and system operation.

Furnish four complete sets of electrical wiring diagrams to Architect-Engineer to be included in the maintenance manuals and three complete sets to Electrical Contractor. Diagrams shall show factory and field wiring of components and controls. Control devices and field wiring to be provided by Electrical Contractor shall be clearly indicated by notation and drawing symbols on wiring diagrams.

Contractor shall obtain complete electrical data on mechanical shop drawings and shall list this data on an approved form that shall be presented monthly or on request, to Electrical Contractor. Data shall be complete with wiring diagrams received to date and shall contain necessary data on electrical components of mechanical equipment such as HP, voltage, amperes, watts, locked rotor current to allow Electrical Contractor to order electrical equipment required in his contract.

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1.17. WORK NOT INCLUDED IN CONTRACT

Consult Division 26 of specifications for work to be provided by Electrical Contractor in conjunction with installation of mechanical equipment.

1.18. CODES, RULES AND REGULATIONS

Provide Work in accordance with applicable codes, rules and regulations of Local and State, Federal Governments and other authorities having lawful jurisdiction.

Conform to latest editions and supplements of following codes, standards or recommended practices.

1.18.1. CODES:

2006 International Building Code

2006 International Fire Code

2006 International Mechanical Code

2006 International Plumbing Code

2008 National Electrical Code

1991 Americans with Disabilities Accessibility Guidelines (ADAAG).

1.18.2. SAFETY CODES:

National Electrical Safety Code Handbook H30 - National Bureau of Standards.

Occupational Safety and Health Standard (OSHA) - Department of Labor.

1.18.3. NATIONAL FIRE CODES:

NFPA No. 13 Standard for the installation of Sprinkler Systems

NFPA No. 14 Standard for the installation of Standpipe and Hose Systems

NFPA No. 54 Gas Appliance & Gas Piping Installation

NFPA No. 70 National Electrical Code

NFPA No. 89M Clearances, Heat Producing Appliances

NFPA No. 90A Air Conditioning and Ventilating Systems

NFPA No. 91 Blower & Exhaust System

NFPA No. 101 Life Safety Code

NFPA No. 204 Smoke & Heating Vent Guide

1.18.4. UNDERWRITERS LABORATORIES INC:

All materials, equipment and component parts of equipment shall bear UL labels whenever such devices are listed by UL.

1.18.5. MISCELLANEOUS CODES:

ANSI A117.1 - Handicapped Accessibility, ASHRAE 90.1 – 1989, Kansas State Boiler Code, Americans with Disabilities Act (ADA)

2. PART 2 – PRODUCTS

Not Used

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3. PART 3 - EXECUTION

3.1. SHOP DRAWINGS

Contractor shall furnish a minimum of six sets of shop drawings of all materials and equipment. Architect-Engineer will retain three sets.

Contractor shall submit two sets of prints of all fabrication drawings. Cost of drawing preparation, printing and distribution shall be paid for by the contractor and included in his base bid.

Where catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, fitting sizes, etc. that are to be provided. Mark each submitted item with applicable section and sheet number of these specifications, or plan sheet number when item does not appear in the specifications. Where equipment submitted does not appear in base specifications or specified equivalent, mark submittals with applicable alternate numbers, change order number or letters of authorization. Each submittal shall contain at least two sets of original catalog cuts. Each catalog sheet shall bear the equipment manufacturer's name and address. All shop drawings on materials and equipment listed by UL shall indicate UL approval on submittal.

Contractor shall check all shop drawings to verify that they meet specifications and/or drawings requirements before forwarding submittals to the Architect-Engineer for their review. All shop drawings submitted to Architect-Engineer shall bear contractor's approval stamp that shall indicate that Contractor has reviewed submittals and that they meet specification and/or drawing requirements. Contractor's submittal review shall specifically check for but not be limited to the following: equipment capacities, physical size in relation to space allowed; electrical characteristics, provisions for supply, return and drainage connections to building systems. All shop drawings not meeting Contractor's approval shall be returned to their supplier for re-submittal.

No shop drawing submittals will be considered for review by the Architect-Engineer without Contractor's approval stamp, or that have extensive changes made on the original submittal as a result of the Contractor's review.

The shop drawing submittal dates shall be at least as early as required to support the project schedule and shall also allow for two weeks Architect-Engineer review time plus mailing time plus a duplication of this time for re-submittal if required. Submittal of all shop drawings as soon as possible before construction starts is preferred. Submit the number of shop drawings required by the General Conditions but not less than 6 copies. All shop drawings submitted shall contain the following: The project name, the applicable specification section and paragraph, the submittal date, the Contractor's stamp which shall certify that the stamped drawings have been checked by the Contractor, comply with the drawings and specifications and have been coordinated with other trades. Submittals not so identified will be returned without action for re-submittal.

The Architect's-Engineer's checking and subsequent approval of such drawings, schedules, literature, or illustrations shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications unless he has, in writing, called the Architect's-Engineer's attention to such deviations at the time of submission, and secured their written approval; nor shall it relieve the contractor from responsibility for errors in dimensions, details, size of members, or omissions of components for fittings; or for coordinating items with actual building conditions and adjacent work.

Any corrections or modifications made by the Architect-Engineer shall be deemed acceptable to the Contractor at no change in price unless written notice is received by the Architect-Engineer prior to the performance of any work incorporating such corrections or modifications.

Shop drawings that require re-submission shall have the items that were revised "flagged" or in some other manner marked to call attention to what has been changed.

Before submitting shop drawings and material lists, verify that all equipment submitted is mutually compatible and suitable for the intended use. Verify that all equipment will fit the available space

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and allow ample room for maintenance. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.

Sheet metal shop drawings for duct fabrication shall be a minimum of 1/4" scale. Sheet metal shop drawings shall not be a reproduction of the contract document and shall show details of the following: Fabrication, assembly, and installation, including plans, elevations above finished floor, sections, components, and attachments to other work. Duct layout indicating pressure classifications and sizes on plans, fittings, reinforcement and spacing, seam and joint construction, penetrations through fire-rated and other partitions, hangers and supports, including methods for building attachment, vibration isolation, seismic restraints, and duct attachment.

Architect-Engineer's review of shop drawings will not relieve Contractor of responsibility for deviations from drawings and specifications unless the Architect-Engineer has specifically approved such deviations in writing, nor shall it relieve the Contractor of responsibility for errors in shop drawings. No work shall be fabricated until Architect-Engineer's review has been obtained. Any time delay caused by correcting and re-submitting shop drawings will be the Contractor's responsibility.

3.2. SUBMITTALS

Contractor shall provide the following submittal sections that apply to this project:

SHEET METAL:

Ductwork, Ductwork materials, Sheet metal specialties and ductwork accessories, Exhaust hoods, Ductwork insulation, Grilles, registers and diffusers, Breechings, chimneys and stacks

HVAC HYDRONIC EQUIPMENT:

Pumps, Boilers, Chillers, Chemical water treatment

HVAC AIR SIDE EQUIPMENT:

Air handling units, Variable air volume boxes, Blower coil units, Furnaces, evaporators & condensing units, Rooftop heating and cooling units, Split system heat pumps, Gas fired unit heater, Through wall units, Condensing units, Ground source heat pumps, Ground source well loops, Indirect gas-fired make-up air handling unit, Exhaust fans, Air filters and housings, Rooftop heat pump units, Open coil duct heaters, Makeup air units, Duct furnaces

MECHANICAL SOUND AND VIBRATION CONTROL:

Vibration isolation, Isolation of piping systems, Isolation of fractional horsepower equipment

SYSTEM TESTING & BALANCING:

Testing Contractor, Balance Report

3.3. OPERATING AND MAINTENANCE INSTRUCTIONS (O & M MANUALS)

Submit with shop drawings of equipment, four copies of installation, operating, maintenance instructions, and parts lists for equipment provided. Equipment manufacturer shall prepare instructions.

Keep in safe place, keys and wrenches furnished with the equipment provided under this contract. Present to the Owner and obtain a receipt for them upon completion of project.

Prepare a complete brochure, covering systems and equipment provided and installed under this contract. Submit brochures to Architect-Engineer for review before delivery to Owner. Brochures shall contain following:

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- Certified equipment drawings/or catalog data with equipment provided clearly marked as outlined above.
- Complete installation, operating, maintenance instructions and parts lists for each item of equipment.
- Special emergency operating instructions with a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to various parts of mechanical system.
- Record Set Drawings: The Contractor shall mark up a set of contract documents during construction all changes and deviations including change orders. These will be delivered to Architect-Engineer at the end of the project. After the originals are changed to reflect the blue line set, a copy shall be included in the brochure.

Provide brochures bound in three-ring binders with metal hinge. Reinforce binding edge of each sheet of loose-leaf type brochure to prevent tearing from continued usage. Clearly print on label insert of each brochure:

- Project name and address.
- Section of work covered by brochure, i.e., "Heating, Ventilating and Air Conditioning", and "Plumbing", etc.

3.4. CUTTING AND PATCHING

Contractor shall do cutting and patching of building materials required for installation of work herein specified. Do not cut or drill through structural members including wall, floors, roofs, and supporting structure, without the Architect's and Structural Engineer's approval and in a manner approved by them.

Make openings in concrete with concrete hole saw or concrete drill. Use of star drill or air hammer for this work will not be permitted.

Patching shall be by the contractors of the particular trade involved and shall meet approval of Architect-Engineer. Damage to building finishes, caused by installation of mechanical work shall be repaired at Mechanical Contractor's expense to approval of Architect-Engineer.

3.5. SETTING, ADJUSTMENT AND EQUIPMENT SUPPORTS

Work shall include mounting, alignment and adjustment of systems and equipment. Set equipment level on adequate foundation and provide proper anchor bolts and isolation as shown, specified or required by manufacturers in installation instructions. Level, shim and grout equipment bases as recommended by manufacturer. Mount motors, align and adjust drive shafts and belts according to manufacturer's instructions.

Equipment failures resulting from improper installation or field alignment shall be repaired or replaced by Contractor at no cost to Owner.

Provide floor or slab mounted equipment with 3-1/2" high concrete bases unless specified otherwise. Mechanical contractor shall form all pads; General contractor shall provide and place all concrete and reinforcing for said pads. Individual concrete pad shall be no less than 4" wider and 4" longer than equipment, and shall extend no less than 2" from each side of equipment.

Provide each piece of equipment or apparatus suspended from ceiling or mounted above floor level with suitable structural support, platform or carrier in accordance with best-recognized practice. Verify that structural members of buildings are adequate to support equipment and

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unless otherwise indicated on plans or specified, arrange for their inclusion and attachment to building structure. Provide hangers with vibration isolators.

Submit details of hangers, platforms and supports together with total weights of mounted equipment to Architect-Engineer for review before proceeding with fabrication or installation.

3.6. START-UP, CHANGEOVER, TRAINING AND OPERATIONAL CHECK

Contractor shall perform the initial start-up of the systems and equipment and shall provide necessary supervision and labor to make the first seasonal changeover of systems. Personnel qualified to start-up and service this equipment, including manufacturer's technicians, and the Owner's operating personnel shall be present during these operations.

Contractor shall be responsible for training Owner's operating personnel to operate and maintain the systems and equipment installed. Keep a record of training provided to Owner's personnel listing the date, subject covered, instructors name, names of Owner's personnel attending and total hours of instruction given each individual.

All owner-training sessions shall be orderly and well organized and shall be videotaped using digital format. At the end of the owner training, the "training tape" shall become property of the owner.

3.7. FINAL CONSTRUCTION REVIEW

At final construction review, each respective Contractor and major subcontractors shall be present or shall be represented by a person of authority. Each Contractor shall demonstrate, as directed by the Architect-Engineer, that the work complies with the purpose and intent of the contract documents. Respective Contractor shall provide labor, services, instruments or tools necessary for such demonstrations and tests.

3.8. MINIMUM CONSTRUCTION STANDARDS

Drawings and specifications indicate minimum construction standard. Should any work indicated be sub-standard to any ordinances, laws, codes, rules or regulations bearing on work, Contractor shall promptly notify Architect-Engineer in writing before proceeding with work so that necessary changes can be made. However, if the Contractor proceeds with work knowing it to be contrary to any ordinances, laws, rules, and regulations, Contractor shall thereby have assumed full responsibility for and shall bear all costs required to correct non-complying work.

3.9. PERMITS, INSPECTIONS, AND UTILITY FEES

The Contractor shall secure and pay for necessary permits and certificates of inspection required by governmental ordinances, laws, rules or regulations. Keep a written record of all permits and inspection certificates and submit two copies to Architect-Engineer with request for final inspection.

The Contractor shall include in their base bid any fees or charges by the local utility providers to establish new services to the structure. Coordinate with the utility suppliers to verify exactly which part of the work required for the new utility service, is to be performed by the contractor and which part will be supplied by the utility company.

END OF SECTION 230100

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SECTION 230500 - BASIC HVAC MATERIALS AND METHODS

1. PART 1 - GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2. PART 2 – PRODUCTS

Not Used

3. PART 3 - EXECUTION

3.1. CLEANING OF SYSTEMS AND EQUIPMENT

After pressure testing of systems and equipment and before operational test thoroughly clean interiors of piping and equipment. Clean equipment as recommended by equipment manufacturers. Where specific instructions are not provided clean equipment systems as follows:

Air Handling Systems: Before starting any air system clean all debris, foreign matter and construction dirt from air system and fan. Provide equipment requiring filters, such as air handling units, fan coil units, blower, etc., with throw-away filters. After cleaning air system install temporary filters and run continuously for a minimum of eight hours at full volume before installing permanent filters. Provide temporary throw-away filters in all permanent heating and air conditioning equipment systems being utilized during construction. Prior to testing and balancing systems remove temporary filter media and install clean unused filters of the type specified. Clean filters shall be installed in equipment by mechanical contractor before final acceptance inspection by Architect and Engineer.

3.2. MAINTENANCE OF SYSTEMS

Contractor shall be responsible for operation, maintenance and lubrication of equipment installed under this contract.

Keep a complete record of equipment maintenance and lubrication and submit two copies with request for final construction review.

Records shall indicate types of lubricants used and date or time when next maintenance or lubrication will need to be performed by Owner. Where special lubricants are required, Contractor shall provide Owner with a one year supply as determine by Equipment Manufacturer's recommendations.

3.3. PAINTING OF MATERIALS AND EQUIPMENT

Touch-up painting and refinishing of factory applied finishes shall be by Mechanical Contractor. Contractor shall be responsible for obtaining proper type of painting materials and color from equipment manufacturer.

Unless specified otherwise factory built equipment shall be factory painted. Paint shall be applied over surfaces only after they have been properly cleaned and coated with a corrosion resistant primer.

After installation, damage to painted surfaces shall be properly prepared and primed with primers equal to factory materials. Finish coating shall be same color and type as factory finish.

Where extensive refinishing is required equipment shall be completely repainted.

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3.4. HAND DAMPER IDENTIFICATION

Provide orange fluorescent tape marking on all hand dampers. Marking shall be located on the outside on the insulation and visible from the finished floor elevation.

3.5. EXCAVATION AND BACKFILL

Perform necessary excavation to receive Work. Provide necessary sheathing, shoring, cribbing, tarpaulins, etc. for this operation, and remove it at completion of work. Perform excavation in accordance with appropriate section of these specifications, and in compliance with OSHA Safety Standards.

Excavate trenches of sufficient width to allow ample working space, and no deeper than necessary for installation work.

Conduct excavations so no walls or footings are disturbed or injured. Backfill excavations made under or adjacent to footing with selected earth or sand and tamp to compaction required by Architect-Engineer. Mechanically tamp backfill under concrete and pavings in six inch layers to 95% standard density, Reference Division 2.

Backfill trenches and excavations to required heights with allowance made for settlement. Tamp fill material thoroughly and moistened as required for specified compaction density. Dispose of excess earth, rubble and debris as directed by Architect.

When available, refer to test hole information on Architectural or Civil drawings or specifications for types of soil to be encountered in excavations.

3.6. EQUIPMENT ANCHORS

Provide floor or foundation mounted equipment such as pumps, boilers, air handling units, etc. with Decatur Engineering Company concrete anchors.

Where equipment anchors cannot be installed during forming of floors or foundations anchor equipment with McCulloch Kwik-Bolt concrete anchors.

Anchors shall be proper type and size recommended by manufacturer for equipment to be anchored.

END OF SECTION 230500

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SECTION 233000 - SHEET METAL

1. PART 1 - GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2. PART 2 – PRODUCTS

2.1. DUCTWORK

Construct ductwork as detailed on drawings and as detailed in the latest edition of the Sheet Metal and Air Conditioning Contractor's Association (SMACNA) HVAC Duct Construction Standards for Metal and Flexible Ducts. Details shown on project plans shall indicate specific construction methods to be used on this project, and shall be used in lieu of any alternate methods shown in the SMACNA Manual.

2.1.1. PRESSURE CLASSIFICATIONS

Construct ductwork in accordance with operating static pressure range. Ductwork pressure classifications shall be as follows:

2.1.1.1. Low Pressure Ductwork (Class C):

System operating static pressure 2" positive or negative of W.G. or less.

Construct low pressure system ductwork to conform to latest edition duct construction standards of SMACNA Duct Construction Standards Manual for Class C sealing.

All ductwork downstream of VAV terminal units and associated with remaining low pressure air handling units shall be constructed according to the low pressure classification.

2.1.1.2. Medium Pressure Ductwork (Class B):

System operating static pressure 3" positive or negative of W.G. or less.

Construct medium pressure system ductwork to conform to latest edition duct construction standards of SMACNA Duct Construction Standards Manual for Class B sealing.

2.1.1.3. High Pressure Ductwork (Class A):

System operating static pressure 4" positive or negative of W.G. and greater.

Construct high pressure system ductwork to conform to latest edition duct construction standards of SMACNA Duct Construction Standards Manual for Class A sealing.

All ductwork upstream of VAV terminal units shall be constructed according to the high pressure classification.

2.2. DUCTWORK MATERIALS

2.2.1. RECTANGULAR OR ROUND STEEL

Provide new commercial quality, bright spangled galvanized sheet steel manufactured in the USA

2.3. DUCTWORK INSULATION

Provide necessary materials and accessories for installation of interior and exterior ductwork insulation as specified and/or detailed on drawings. Insulation type and thickness for specific ductwork systems shall be as listed in insulation schedule in this section of specification. Provide

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insulation materials manufactured by Schuller, Knauf Fiberglass, Certain/Teed, or Owens-Corning Fiberglas.

Insulation and application adhesives, except where specified otherwise, shall have fire and smoke hazard rating as tested by ASTM E-84 procedure not exceeding:

FLAME SPREAD	25
SMOKE DEVELOPED	50
FUEL CONTRIBUTED	50

Insulation shall meet ASTM C411 performance test and shall be installed in conformance with NFPA Standard 90A.

Install interior duct liner insulation cut to insure tight fitting corner, and longitudinal joints. Apply liner to sheet metal with 100% coverage of adhesive applied in accordance with manufacturers recommended applications rate. Coat all edges of liner with adhesive. Provide mechanical fasteners on surfaces 18" or wider in addition to liner adhesive with fastener clips set flush with duct liner surface. Provide fasteners as follows:

Low Velocity Ductwork (Velocities less than 2000 FPM): Provide fasteners within 3" of leading edge of each section 12" O.C. around joint perimeter and 3" from longitudinal joints 12" O.C. Elsewhere space fasteners 18" O.C. except not more than 6" from longitudinal joints and not 12" from corner break.

Provide round sheet metal ductwork with exterior thermal insulation of type and thickness listed in insulation schedule. Apply insulation with joints tightly butted together with longitudinal and end joint strips sealed with vapor barrier adhesive. Insulate fittings with insulation thickness equal to adjoining insulation with cover overlapping 2" onto adjacent covering.

Eliminate ductwork insulation on exposed round ductwork unless noted otherwise in ductwork insulation schedule.

Duct insulation materials by type shall be as follows:

2.3.1. Type 1-DIL (Duct interior liner)

Internal acoustical and thermal duct insulation for low and high velocity ductwork shall be 2 lb. density for ½" thick and 1.5 lb. density for 1" thick duct liner with 1.08 @ 1000 FPM friction coefficient and .24 BTUH thermal conductivity at 75 degrees mean temperature.

2.3.2. Type 2-DEW (Duct exterior wrap)

External thermal insulation for low, medium and high pressure duct shall be 1.0 lb. density standard duct insulation type IV with foil-scrim-craft facing and .27 BTUH thermal conductivity at 75 degrees mean temperature.

2.4. DUCT INSULATION SCHEDULE

DUCTWORK SYSTEM	TYPE	THICKNESS
Rectangular Supply & Return	1-DIL	½"
Rectangular Outside Air	1-DIL	1"
High Pressure Ductwork	2-DEW	1-1/2"
Rectangular Exhaust	1-DIL	½"

Round Exhaust	2-DEW	1-1/2"
Relief and Return Air Boots	1-DIL	1/2"
Low Pressure Round Ductwork	3-DEW	1-1/2"
Kitchen Grease Hood Exhaust	4-DEW	2 1/4"

Omit internal insulation on exhaust ductwork from kitchen hoods.

3. PART 3 - EXECUTION

3.1. DUCTWORK INSTALLATION

All ductwork shall be installed in strict accordance with SMACNA "HVAC Duct Construction Standards" First Edition 1985. All ductwork accessories shall be installed in strict accordance with manufacturer's requirements SMACNA, NFPA 90A and 90B, UL listings and drawing details. Grilles, registers and diffusers shall be installed in accordance with SMACNA requirements, where balancing dampers are not provided in duct work preceding diffusers, provide opposed blade balancing damper in neck of diffuser.

Construct and install ductwork to be completely free from vibration under all conditions of operation. Support and securely anchor ductwork and equipment from structural framing of building. Provide suitable intermediate metal framing where required between building structural framing.

3.2. DUCT CONSTRUCTION

All metal ductwork scheduled for interior thermal and acoustical liner is not sized on plans to include the proper thickness of insulation. Add 1" or 2" in height and width of ductwork as required to accommodate insulation thickness. Mount specialties such as turning vanes, dampers, etc., to ductwork with that section insulated "Build Outs" to maintain continuity of thermal barrier.

Provide spiral wound duct on all round ductwork greater than 10" diameter.

Provide longitudinal seam duct on all round ductwork 10" diameter or less.

3.3. DUCTWORK SEALING

Sealing of ductwork shall be as follows:

3.3.1. Option #1

Ductwork: Including supply, return and exhaust. Provide Hard Cast, Inc. mineral impregnated woven fiber tape and activator/adhesive in accordance with manufacturers' directions on all joints, connectors, etc.

3.3.2. Option #2

Rectangular ductwork: Provide "Ductmate" systems as manufactured by Ductmate Industries, Inc. or an approved equal system.

3.3.3. Option #3

Ductwork: Including supply, return and exhaust. Provide Hard Cast, Inc. "Foil Grip" pressure sensitive duct joint sealer. Seal class "A", "B", and "C".

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3.3.4. Option #4

Ductwork: Including supply, return and exhaust. Provide liquid or mastic sealant specifically designed and tested for duct sealing. Apply in accordance with manufacturers' directions on all joints, connectors, etc. This option is acceptable for low pressure Class "C" ductwork only.

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SECTION 236000 - HVAC AIR SIDE EQUIPMENT

1. PART 1 - GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2. PART 2 – PRODUCTS

2.1. ROOFTOP HEATING AND COOLING UNITS (Less than 12 ½ ton units)

Provide where shown on plans, rooftop units as hereinafter specified and indicated in the schedule. Equivalents by Trane, Carrier, York, McQuay, Lennox.

Provide dedicated downflow or horizontal gas heating electric cooling rooftop air handling units capable of operating range between 115°F and 0°F cooling as shown on plans. Cooling performance shall be rated in accordance with DOE and /or ARI testing procedures. Unit shall be factory assembled, internally wired, fully charged with R-22 and 100 percent run-tested before leaving the factory. Wiring internal to the unit shall be colored and numbered. Unit shall be UL listed and labeled, classified in accordance to ANSI Z21.47 for gas-fired central furnaces and UL 1995/CAN/CSA No. 236-M90 for central cooling air conditioners.

Unit casing shall be constructed of zinc coated, min. 18 ga., galvanized steel. Exterior surfaces shall be cleaned, phosphatized and finished with a weather-resistant baked enamel finish. Unit's surface shall be tested 500 hours in a salt spray test in compliance with ASTM B117. Cabinet construction shall allow for all maintenance on one side of the unit. Service panels shall have lifting handles and be removable while providing a water and airtight seal. The unit's base pan shall have no penetrations within the perimeter of the curb other than the raised 1-1/8" high supply/return openings to provide an added water integrity precaution, if the condensate drain backs up. The base of the unit shall have provisions for forklift and crane lifting. The top cover shall be one piece or where seams exist, it shall be double hemmed and gasket sealed.

Unit shall have direct-drive hermetic, reciprocating type compressor with centrifugal oil pump providing positive lubrication to moving parts. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage. Crankcase heater, internal temperature and current-sensitive motor overloads shall be included for maximum protection. Internal spring isolation and sound muffling shall be provided. External high pressure cutout shall be provided. Low pressure switches shall be standard.

Each refrigerant circuit shall have independent fixed orifice expansion devices, service pressure ports and refrigerant line filter driers. An area shall be provided for replacement suction line driers.

Provide internally finned 3/8" copper tubes mechanically bonded to configured aluminum plate fin evaporator and condenser coils. Coils shall be leak tested at the factory to ensure pressure integrity. The evaporator coil and condenser coil shall be leak tested to 200 psig and pressure tested to 450 psig.

The heating section shall have a drum and tube heat exchanger design using corrosion resistant steel components. A forced combustion blower shall supply premixed fuel to a single burner ignited by a pilotless hot surface ignition system. A negative pressure gas valve shall be used that requires blower operation to initiate gas flow. On an initial call for heat, the combustion blower shall purge the heat exchanger 45 seconds before ignition. After three unsuccessful attempts, the entire heating system shall be locked out until manually reset at the thermostat. Unit shall be suitable for use with natural gas. All units shall have two-stage heating.

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The outdoor fans shall be direct-drive, statically and dynamically balanced, draw-through in the vertical discharge position. The fan motor shall be permanently lubricated and have built-in thermal overload protection.

Unit shall have belt driven, FC centrifugal fans with adjustable motor sheaves. Unit shall have an adjustable idler-arm assembly for quick-adjustment to fan belts and motor sheaves. All motors shall be thermally protected. Oversized motors shall be available for high static operations. Refer to schedule.

Unit shall be completely factory wired with necessary controls and contactor pressure lugs or terminal block for power wiring. Units shall provide an external location for mounting fused disconnect device. Micro-processor controls shall be provided for all 24 volt control functions. The resident control algorithms shall make all heating, cooling and/or ventilating decisions in response to electronic signals from sensors measuring indoor and outdoor temperatures.

Provide roof curb designed to mate with the downflow unit and provide support and a watertight installation. The roof curb design shall allow field-fabricated rectangular supply/return ductwork to be connected directly to the curb. Curb design shall comply with NRCA requirements. Curb shall ship knocked down for field assembly and include wood nailer strips.

Provide field-installed circuit board to interface unit with 7-day programmable thermostat.

Economizer shall be factory installed. The assembly includes - fully modulating 0-100 percent motor and dampers, barometric relief, 10% minimum position setting, preset linkage, wiring harness with plug and fixed dry bulb control. The factory-installed economizer arrives in the shipping position and shall be moved to the operating position by the installing contractor.

Provide Farr 30/30 two-inch filters or equal.

Provide unit with louvered hail guards.

Provide low ambient accessories to allow operation to 0 degrees F.

3. PART 3 - EXECUTION

All HVAC air side equipment shall be cleaned and free of all construction debris. Install units as shown and detailed on the plans and per manufacturers directions.

See plans for equipment schedules.

END OF SECTION 236000

SECTION 237000 - MECHANICAL SOUND AND VIBRATION CONTROL

1. PART 1 - GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2. PART 2 – PRODUCTS

Equivalents by Amber-Booth Company, Mason Industries, Peabody Noise Control (Kinetics).

2.1. VIBRATION ISOLATION

Furnish and install vibration isolation devices for rotating or reciprocating mechanical equipment and piping systems attached thereto.

Work shall include all material and labor required for installation of the resilient mounting and suspension systems, adjusting each mounting system, and measurement of isolator system performance when so requested by the Architect-Engineer. Specific mounting arrangements for each item of mechanical equipment shall be as described herein and as indicated by schedules and details on the drawings.

All vibration isolation equipment, including steel framing and reinforcing for concrete inertia bases and including steel rail bases, shall be furnished by one of the following manufacturers: Peabody Noise Control, Mason Industries, or Amber Booth. A single manufacturer for all vibration isolation equipment will be required except as specifically approved in writing by the Architect-Engineer or by his specific approval of shop drawings.

The Contractor and the vibration isolation manufacturer or his regularly designated and factory authorized representative shall perform the following tasks in addition to the supply and installation of isolation equipment:

Obtain from the Architect-Engineer the approved manufacturer's name, model number, and other necessary identifying data for each item of mechanical and electrical equipment to be resiliently mounted. Coordinate all resilient mounting systems with the exact equipment to be furnished in regard to physical size, isolator locations, weight, rotating speed, etc. Direct contact and cooperation between the vibration isolation device fabricator and the equipment manufacturer will be required.

Obtain all necessary data in regard to piping systems which are to be resiliently supported so that proper isolators can be selected. Select piping system isolators for proper coordination with the physical arrangement of pipe lines and with the physical characteristics of the building.

Submit shop drawings as required by other portions of this specification. These drawings shall include specification information as follows:

Manufacturer's model number for each isolator, the machine or pipeline to which it is to be applied, and the number of isolators to be furnished for each machine or pipeline.

For steel spring mounts or hangers - free height, deflected height, solid height, isolator loading, and diameter of spring coil.

For elastomer or glass fiber isolators - free height, deflected height, and isolator loading.

Dimensional and weight data for concrete inertia bases, steel and rail bases, and details of isolator attachment.

Provide on-the-job supervision as required during installation of resiliently mounted equipment and piping to assure that all vibration isolators are installed in strict accordance with normally accepted

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practices for critical environments.

Replace at no extra cost to the Owner any isolators which do not produce the required deflection, are improperly loaded above or below their operating height, or which in any way do not produce the required isolation.

Cooperate with all other Contractors engaged in this project so that the installation of vibration isolation devices will proceed in a manner that is in the best interests of the Owner.

Notify the Architect-Engineer of any project conditions which affect vibration isolation system installation or performance and which are found to be different from conditions indicated by the drawings or described by the specifications. Should vibration isolation system installation proceed without such notifications any remedial work required to achieve proper isolator performance shall be accomplished by the Contractor at no additional cost to the Owner.

Be alert for possible "short-circuiting" of vibration isolation systems by piping supports, electrical connections, temperature control connections, drain lines, building construction, etc., and notify the involved contractor as to these problems or potential problems. Where such situations cannot be easily resolved, notify the Architect-Engineer so that preventive or remedial action can take place on a timely basis. Any remedial measures required shall be undertaken by the Contractor responsible at no additional cost to the Owner.

3. PART 3 - EXECUTION

The vibration isolation systems described herein and identified by type letter designations shall be applied to specific classifications of mechanical and electrical equipment as indicated in this specification.

3.1. TYPE F ISOLATION (Curb Mounted Roof-Top Air Conditioning Machines)

The roof-top air conditioning machine shall be mounted on a free standing steel spring isolated rectangular rail (curb) system which in turn is mounted on a roof curb as normally used to mount the machine when vibration isolation is not used. The isolation system shall be suitable for outdoor unprotected locations and it shall include a soft and flexible elastomer air and water seal which shall not short circuit the spring isolators. The spring isolators shall provide uniform deflection of not less than 0.9 inch for the entire machine. The isolation system shall not allow lateral movement greater than 5/8 inch for wind loads up to 100 miles per hour. Suitable systems of this type are Peabody Noise Control Type ASR, Mason Industries Type CMAB, and Amber Booth Type RTIR.

3.2. RESILIENT MOUNTINGS FOR SPECIFIC CLASSIFICATIONS OF EQUIPMENT

Equipment	Power HP or as Noted	Rotating Speed RPM	Mounting Type	Inertia Base*	Static Deflection**
Pumps all except In-The-Line Type	--	1750	A	2	1.5"
Floor mounted AHU's	1 - 50	500 and Up	B		.75"
Suspended AHU's, fan coils, and other Suspended Equipment	0 - 7-1/2	500 and Up	D		.75"
Rooftop units	7-1/2 - 50	500 and Up	F		.75"

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* Minimum inertia base weight expressed as multiple of weight of supported equipment.

** Minimum static deflection of isolators specified for mounting type indicated.

3.3. ISOLATION OF PIPING SYSTEMS

All piping which connects to resiliently mounted equipment shall be suspended with resilient hangers or supported by floor mounted isolators for a distance of 100 pipe diameters from the connected machine or within the mechanical equipment room whichever is the greater distance. The first three supports from the connected machine shall have the same static deflection as indicated for the machine; the next two supports shall have static deflection at least equal to one-half of the static deflection indicated for the machine mounting, and remaining pipe supports shall provide static deflection of 0.35 inches minimum. These remaining isolators may be elastomer.

Steel spring hangers shall be as specified for Type D isolation except that a scale shall be attached to the hanger housing to indicate deflection. Elastomer hangers shall be as specified for Type E isolation. Floor mounts shall be free standing steel spring isolators as specified for Type A isolation where static deflection in excess of 0.35 inches is required. Floor mounts, where static deflection of 0.35 inches or less is required, shall be double deflection neoprene-in-shear as specified for Type C isolation.

Vertical pipe risers shall be resiliently mounted, preferably with each riser anchored near the center of the run. The risers shall be supported at the anchor points with steel spring or double deflection neoprene-in-shear isolators which provide static deflection of at least 0.35 inches. Isolators for the remainder of each run shall be steel spring type specifically designed to control load shifting due to pipe expansion and contraction. At least 0.35 inches deflection shall be maintained under all conditions.

Flexible neoprene connectors shall be used to connect all piping to all isolated equipment except equipment for which flexible connectors are not permitted by code. For this application provide swing connectors changing direction a minimum of 3 times before joining isolated equipment. Swing connections should be made within approximately 6 feet of the isolated equipment. Connectors shall be manufactured of multiple plies of nylon tire cord fabric and neoprene both molded and cured in hydraulic presses. No steel wire or rings shall be used as pressure reinforcement. Connectors up to and including 2" diameter may have threaded ends. Connectors 2-1/2 inches and larger shall be manufactured with floating steel flanges. All connections shall be rated a minimum of 150 psi at 220 degrees F. All flanged equipment shall be directly connected to neoprene elbows in the size range 2-1/2 inches through 6 inches or any larger available size if the piping makes a 90 degree turn at the equipment. All straight through connections shall be made with either flanged or screwed connectors properly pre-extended as recommended by the manufacturer to prevent additional elongation under pressure. Sizes 12 inches and larger operating at pressures above 100 psi shall employ control cables with end fittings isolated from the anchoring plates by means of 1/2 inch thick bridge bearing neoprene washer bushing designed for a maximum of 1000 psi. Elbows shall be Mason-Flex type MFNEC, straight connectors Mason-Flex type MFTFU or MFTNC, and control cables assemblies type ACC, all as manufactured by Mason Industries, Inc.

Drain connections from isolated equipment to floor drains shall be at least 1" free from drain or use rubber hose.

3.4. ISOLATION OF FRACTIONAL HORSEPOWER EQUIPMENT

All fractional horsepower fans, pumps, etc., which are mounted on or suspended from floors that are on-grade shall be isolated with neoprene-in-shear isolators furnished by the vibration isolation supplier except where such isolators are furnished as an integral part of the machine.

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END OF SECTION 237000

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SECTION 239900 - SYSTEM TESTING & BALANCING

1. PART 1 - GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. TESTING AND BALANCING CONTRACTORS

Testing and balancing (TAB) of the building air and hydronic systems will be to be completed near the end of construction. The Mechanical Contractor has responsibility to cooperate with, make adjustments for, and provide any equipment necessary for the TAB contractor to complete the job.

Acceptable Testing and Balancing Contractors:

Energy Management and Control Corporation, Topeka, Kansas

Allied Labs, Wichita, Kansas

Environmental Systems Testing, Lenexa, Kansas

Doyle Field Services, KC, Missouri

Pro Balance, Blue Springs, Missouri

2. PART 2 – PRODUCTS

Not Used

3. PART 3 - EXECUTION

3.1. SYSTEM PREPARATION FOR TESTING AND BALANCING

Prior to requesting testing and balancing contractor to perform their work the installing contractor shall make all necessary inspections and adjustments to insure that systems are completely installed and operating in accordance with the manufacturer's recommendations and the contract documents.

The following checks shall be performed on each system installed under this contract. A report sheet shall be prepared for each system indicating checks made, corrective action taken where required, date, and name of person making inspection. Submit one copy to testing and balancing contractor and two to A/E. Testing and balancing contractor will not begin until checklist has been received and reviewed.

3.2. TEMPERATURE CONTROLS CONTRACTOR COORDINATION

The temperature control contractor shall have a technical representative present with the balancing contractor on the first day of balancing for a minimum of four hours of active balancing and temperature controls coordination.

For the remainder of the balancing the temperature contractor may either have a technical representative present, or may furnish the balancer with the latest DDC software and all required interface devices. This includes instructions and coordination in the use of all interface devices, including laptop computers. There shall be no charge to the balancing contractor for the use of these interface devices and they shall be returned to the temperature controls contractor at the end of the balancing process.

3.3. AIR HANDLING SYSTEMS:

Clear system of all foreign objects and clean system.

Verify fan rotation.

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Check bearing condition and lubrication.

Check fan wheel clearances and fan alignment.

Check motor security to mounting base.

Check alignment of drive.

Check vibration isolator adjustment.

Verify that proper filter media is installed.

Verify that all control dampers are installed and operable without binding or sticking.

Confirm that all fire, smoke and volume dampers are installed and in full open position.

Verify that all air terminal units are installed.

Confirm that all air openings in walls above ceilings have been provided.

Check for and repair all excessive air leaks in duct systems, at equipment connections and at coils.

Air leaks shall not exceed SMACNA parameters for system pressure.

Verify that ductwork is constructed and installed in accordance with contract drawings and/or approved ductwork shop drawings.

Inspect and clean all coils(including evaporator and condenser) and correct fin damage.

3.4. AIR AND WATER BALANCE

The Contractor shall procure the services of an independent air balance and testing contractor, approved by the A/E, which specializes in the balancing and testing of heating, ventilating and air conditioning systems, to balance, adjust, and test air moving equipment and air distribution and exhaust systems and all water flow circuits. All work by this contractor shall be done under engineer employed by them. All instruments used by this contractor shall be accurately calibrated and maintained in good working order. If requested the tests shall be conducted in the presence of the A/E responsible for the project and/or his representative. The testing and balancing contractor shall be certified by NEBB or AABC and all work shall be performed in accordance with these organizations' published procedure manuals.

The balancing contractor shall prepare a certified report of all tests performed. The report shall be written on standard forms prepared by NEBB or AABC or facsimiles thereof. The balancing contractor shall submit 3 copies of this report to the Mechanical Contractor who shall submit them to the A/E for review and distribution.

Air balance and testing shall not begin until systems have been completed and are in full working order. All heating, ventilation, and air conditioning systems and equipment shall be in full operation during each working day of testing and balancing.

The Balancing reports shall include the line drawing of each ductwork system as installed, a line drawing of the heating and cooling water piping as installed; an elevation of each air handling unit as installed showing outdoor air return air an supply air ductwork connections, coil arrangements and damper arrangements, a psychometric chart on each air handling unit, with a cooling coil, showing outdoor temperature, return air temperature, mixed air temperature at a minimum outdoor air condition, coil leaving air condition at full cooling coil water flow. The balancing report shall also include all NEBB or AABC forms completed as required by each respective certification.

The TAB contractor shall cycle each air handling unit through its control sequence of operation to verify proper operation. Any inconsistency with contract documents shall be reported to A/E and temperature control contractor. Temperature control contractor shall take prompt action to correct any control inconsistency as reported by the TAB contractor.

During installation of the mechanical systems the testing and balancing contractor shall make no less than (3) inspection visits to the project site. Proper placement and installation of all control

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and balancing devices shall be verified by these inspections. The mechanical contractor shall make all corrections in control and balancing device locations as requested by the TAB contractor. Following each inspection visit the TAB contractor shall report to the A/E all items noted, action taken, and progress of control device installation. The last inspection and balancing shall be performed in the presence of a professional engineer active in the design of mechanical building systems.

END OF SECTION 239900

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SECTION 260100 - ELECTRICAL PROVISIONS

1. PART 1 - GENERAL

1.1. RELATED DOCUMENTS

All contract documents including drawings, alternates, addenda and modifications and general provisions of the Contract, including General and Supplementary Conditions and all other Division Specification Sections, apply to work of this section. All preceding and following sections of this specification division are applicable to the Electrical Contractor, all sub-contractors, and all material suppliers.

1.2. SCOPE OF WORK

This DIVISION requires the furnishing and installing of complete functioning Electrical systems, and each element thereof, as specified or indicated on Drawings or reasonably inferred, including every article, device or accessory reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the Work include materials, labor, supervision, supplies, equipment, transportation, and utilities.

Refer to Architectural, Structural and Mechanical Drawings and all other contract documents and to relevant equipment drawings and shop drawings to determine the extent of clear spaces and make all offsets required to clear equipment, beams and other structural members to facilitate concealing conduit in the manner anticipated in the design.

1.3. SPECIFICATION FORM AND DEFINITIONS

The Engineer indicated in these specifications is Pearson Kent McKinley Raaf Engineers LLC. 2933 SW Woodside Dr., Suite C, Topeka, KS, 66614, PHONE 785-273-2447, FAX 785-273-0456, EMAIL scott.mckinley@pkmreng.com.

Contractor, wherever used in these specifications, shall mean the Company that enters into contract with the Owner to perform this section of work.

When a word, such as "proper", "satisfactory", "equivalent", and "as directed", is used, it requires the Architect-Engineer's review. "Provide" means to furnish and install in a satisfactory working condition.

1.4. QUALIFICATIONS

The contractors responsible for work under this section shall have completed a job of similar scope and magnitude within the last 3 years. The contractors shall employ an experienced, competent and adequate work force licensed in their specific trade and properly supervised at all times. Unlicensed workers and general laborers shall be adequately supervised to insure competent and quality work and workmanship required by this contract and all other regulations, codes and practices. At all times the contractors shall comply with all applicable local, state and federal guidelines, practices and regulations. Contractor may be required to submit a statement of qualifications upon request before any final approval and selection. Failure to be able to comply with these requirements is suitable reason for rejection of a bid.

1.5. LOCAL CONDITIONS

The contractor shall visit the site and determine the existing local conditions affecting the work required. Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

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1.6. CONTRACT CHANGES

Changes or deviations from the contract documents; including those for extra or additional work must be submitted in writing for review of Architect-Engineer. No verbal change orders will be recognized.

1.7. LOCATIONS AND INTERFERENCES

Locations of equipment, conduit and other electrical work are indicated diagrammatically by electrical drawings. Layout work from dimensions on Architectural and Structural Drawings. Verify equipment size from manufacturers shop drawings.

Study and become familiar with contract drawings of other trades and in particular general construction drawings and details in order to obtain necessary information for figuring installation. Cooperate with other workmen and install work in such a way to avoid interference with their Work. Minor deviations, not affecting design characteristics, performance or space limitation may be permitted if reviewed prior to installation by Architect-Engineer.

Any conduit, apparatus, appliance or other electrical item interfering with proper placement of other work as indicated on drawings, specified, or required, shall be removed, relocated and reconnected without extra cost. Damage to other Work caused by this contractor, subcontractor, workers or any cause whatsoever, shall be restored as specified for new work.

Do not scale electrical drawings for dimensions. Accurately layout work from dimensions indicated on Architectural drawings unless they are found to be in error.

1.8. PERFORMANCE

Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus and appliances operate satisfactorily as designed and intended. Work shall include required adjustment of systems and control equipment installed under this specification division.

The Contractor warrants to the Owner and Architect-Engineer the quality of materials, equipment, workmanship and operation of equipment provided under this specification division for a period of one year from and after completion of building and acceptance of mechanical systems by Owner.

1.9. WARRANTY

The Contractor warrants to the Owner and Architect-Engineer that upon notice from them within a one year warranty period following date of acceptance, that all defects that have appeared in materials and/or workmanship, will be promptly corrected to original condition required by contract documents at Contractor's expense.

The above warranty shall not supersede any separately stated warranty or other requirements required by law or by these specifications.

1.10. ALTERNATES

Refer to General Requirements for descriptions of any alternates that may be included.

1.11. MATERIALS, EQUIPMENT AND SUBSTITUTIONS

The intent of these specifications is to allow ample opportunity for the Contractor to use their ingenuity and abilities to perform the work to their and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required.

Material and equipment installed under this contract shall be first class quality, new, unused and without damage.

West Pryor Lot 3

In general, these specifications identify required materials and equipment by naming one or more manufacturer's brand, model, catalog number and/or other identification. The first named manufacturer or product is used as the basis for design; other manufacturers named must furnish products consistent with specifications of first named product as determined by Engineer. Base bid proposal shall be based only on materials and equipment by manufacturers named, except as hereinafter provided.

Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to Architect-Engineer for review prior to procurement.

Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color as determined by Architect-Engineer whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by two copies of complete descriptive and technical data including manufacturer's name, model and catalog number, photographs or cuts, physical dimensions, operating characteristics and any other information needed for comparison.

If the Contractor wishes to incorporate products other than those named in the Base Bid Specifications they shall submit a request for approval of equivalency in writing no later than (10) ten calendar days prior to bid date. Substitutions after this may be refused at Engineers option. Equivalents will ONLY be considered approved when listed by addendum.

In proposing a substitution prior to or subsequent to receipt of bids, include in such bid the cost of altering other elements of this project, including adjustments in mechanical or electrical service requirements necessary to accommodate such substitution.

Within 10 working days after bids are received, the apparent low bidder shall submit to the Architect-Engineer for approval, three copies of a list of all major items of equipment they intend to provide. Within 30 working days after award of Contract, Contractor shall submit shop drawings for equipment and materials to be incorporated in work, for Architect-Engineer review. Where 30-day limit is insufficient for preparation of detailed shop drawings on major equipment or assemblies, Contractor shall submit manufacturer's descriptive catalog data and indicate date such detailed shop drawings will be submitted along with manufacturer's certification that order was placed within 30 working day limit.

1.12. ELECTRONIC PLAN FILES

Electronic files of the contract documents may be available from the Engineer to successful bidders and manufacturers for a fee of \$50 per sheet, \$100 minimum and \$25 email/shipping charge. A release of liability form will be required along with payment prior to release of files.

1.13. OPENINGS, ACCESS PANELS AND SLEEVES

This Contractor shall include the installation of all boxes, access panels and sleeves for openings required to install this work, except structural openings incorporated in the structural drawings. Sleeves shall be installed for all conduits passing through structural slabs and walls. Contractor shall set and verify the location of sleeves that pass through beams, as shown on structural plans. All floor and wall penetrations shall be sealed to meet fire-rating requirements.

1.14. ARCHITECTURAL VERIFICATION AND RELATED DOCUMENTS

Contractor shall consult all Architectural Drawings and specifications in their entirety incorporating and certifying all millwork, furniture, and equipment rough-in including utility characteristics such as

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voltage, phase, amperage, pipe sizes, duct sizes, including height, location and orientation. Shop drawings incorporating these requirements should be submitted to the Architect for approval prior to installation or rough in.

1.15. EXTENT OF CONTRACT WORK

Provide electrical systems indicated on drawings, specified or reasonably implied. Provide every device and accessory necessary for proper operation and completion of electrical systems. In no case will claims for "Extra Work" be allowed for work about which Electrical Contractor could have been informed before bids were taken.

Electrical Contractor shall be familiar with equipment provided by other Contractors that require electrical connections and control. Follow circuiting shown on drawings for lighting, power and equipment connections.

Make required electrical connections to equipment provided under Architectural and Mechanical divisions of this project. Receive and install electric control devices requiring field installation, wiring, and service connection. Equipment supplied by the automatic temperature control contractor shall be installed by the mechanical or automatic temperature control subcontractor. Make required internal field wiring modifications indicated on wiring diagrams of factory installed control systems for control sequence specified. These field modifications shall be limited to jumper connections and connection of internal wiring to alternate terminal block lugs. The cost for field modifications requiring rewiring of factory installed control systems for equipment provided by General or Mechanical Contractors shall be included in base bid of the respective contractor. All temperature control wiring shall be by a licensed electrician under the supervision of temperature control contractor.

Check electrical data and wiring diagrams received from Mechanical Contractor of compliance with project voltages, wiring, controls and protective devices shown on electrical drawings. Promptly bring discrepancies found to attention of Architect-Engineer for a decision.

Provide safety disconnect switches, contactors, and manual and magnetic motor starters for mechanical and electrical equipment requiring such devices. Omit these devices where included as part of factory installed prewired control systems provided with mechanical equipment. With exception of factory installed devices, provide safety disconnect switches, contacts and motor starters by one manufacturer to allow maximum interchangeability of repair parts and accessories for these devices.

To maximum extent possible electrical controls in boiler rooms, equipment rooms, and control rooms shall be grouped in accessible locations and arranged according to function. Where possible use group control panels and combination starters in lieu of individually enclosed devices.

1.16. CODES, ORDINANCES, RULES AND REGULATIONS

Provide work in accordance with applicable rules, codes, ordinances and regulations of Local, State, Federal Governments, and other authorities having lawful jurisdiction.

Conform to latest editions and supplements of following codes, standards or recommended practices.

1.17. SAFETY CODES:

National Electrical Safety Code Handbook H30 - National Bureau of Standards

Occupational Safety and Health Standard (OSHA) Department of Labor

Safety Code for Elevators ANSI A17.1

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1.18. NATIONAL FIRE CODES:

NFPA No. 54	Gas Appliances & Gas Piping Installation
NFPA No. 70	National Electric Code
NFPA No. 90A	Air Conditioning & Ventilation Systems
NFPA No. 91	Blower and Exhaust Systems
NFPA No. 101	Life Safety Code

1.19. UNDERWRITERS LABORATORIES INC.:

All materials, equipment and component parts of equipment shall bear UL labels whenever such devices are listed by UL.

1.20. MISCELLANEOUS CODES:

ANSI A117.1 - Handicapped Accessibility

ASHRAE 90.1 1989

Americans with Disabilities Act (ADA)

Drawings and specifications indicate minimum construction standard, should any work indicated be sub-standard to any ordinances, laws, codes, rules or regulations bearing on work, Contractor shall promptly notify Architect/Engineer in writing before proceeding with work so that necessary changes can be made. However, if Electrical Contractor proceeds with work knowing it to be contrary to any ordinances, laws, rules, and regulations he shall thereby have assumed full responsibility for and shall bear all costs required to correct non-complying work.

Electrical Contractor shall secure and pay for necessary permits and certificates of inspection required by governmental ordinances, laws, rules or regulations. Keep a written record of all permits and inspection certificates and submit two copies to Architect/Engineer with request for final review.

Contractor shall include in bid any charges by local utility providers to establish new services to the structure. Coordinate with the utility suppliers to verify exact which part of the work is to be performed by whom.

2. PART 2 – PRODUCTS

Not Used

3. PART 3 - EXECUTION

3.1. SHOP DRAWINGS

Contractor shall furnish a minimum of six sets of shop drawings of all materials and equipment. Architect-Engineer will retain three sets.

Contractor shall submit two sets of prints of all fabrication drawings. Cost of drawing preparation, printing and distribution shall be paid for by the contractor and included in his base bid.

Where catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, fitting sizes, etc. that are to be provided. Mark each submitted item with applicable section and sheet number of these specifications, or plan sheet number when item does not appear in the specifications. Where equipment submitted does not appear in base specifications or specified equivalent, mark submittals with applicable alternate numbers, change order number or letters of authorization. Each submittal shall contain at least two sets of original

catalog cuts. Each catalog sheet shall bear the equipment manufacturer's name and address. All shop drawings on materials and equipment listed by UL shall indicate UL approval on submittal.

Contractor shall check all shop drawings to verify that they meet specifications and/or drawings requirements before forwarding submittals to the Architect-Engineer for their review. All shop drawings submitted to Architect-Engineer shall bear contractor's approval stamp that shall indicate that Contractor has reviewed submittals and that they meet specification and/or drawing requirements. Contractor's submittal review shall specifically check for but not be limited to the following: equipment capacities, physical size in relation to space allowed; electrical characteristics, provisions for supply, return and drainage connections to building systems. All shop drawings not meeting Contractor's approval shall be returned to their supplier for re-submittal.

No shop drawing submittals will be considered for review by the Architect-Engineer without Contractor's approval stamp, or that have extensive changes made on the original submittal as a result of the Contractor's review.

The shop drawing submittal dates shall be at least as early as required to support the project schedule and shall also allow for two weeks Architect-Engineer review time plus mailing time plus a duplication of this time for re-submittal if required. Submittal of all shop drawings as soon as possible before construction starts is preferred. Submit the number of shop drawings required by the General Conditions but not less than 6 copies. All shop drawings submitted shall contain the following: The project name, the applicable specification section and paragraph, the submittal date, the Contractor's stamp which shall certify that the stamped drawings have been checked by the Contractor, comply with the drawings and specifications and have been coordinated with other trades. Submittals not so identified will be returned without action for re-submittal.

The Architect's-Engineer's checking and subsequent approval of such drawings, schedules, literature, or illustrations shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications unless he has, in writing, called the Architect's-Engineer's attention to such deviations at the time of submission, and secured their written approval; nor shall it relieve the contractor from responsibility for errors in dimensions, details, size of members, or omissions of components for fittings; or for coordinating items with actual building conditions and adjacent work.

Any corrections or modifications made by the Architect-Engineer shall be deemed acceptable to the Contractor at no change in price unless written notice is received by the Architect-Engineer prior to the performance of any work incorporating such corrections or modifications.

Shop drawings that require re-submission shall have the items that were revised "flagged" or in some other manner marked to call attention to what has been changed.

Before submitting shop drawings and material lists, verify that all equipment submitted is mutually compatible and suitable for the intended use. Verify that all equipment will fit the available space and allow ample room for maintenance. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.

Architect-Engineer's review of shop drawings will not relieve Contractor of responsibility for deviations from drawings and specifications unless the Architect-Engineer has specifically approved such deviations in writing, nor shall it relieve the Contractor of responsibility for errors in shop drawings. No work shall be fabricated until Architect-Engineer's review has been obtained. Any time delay caused by correcting and re-submitting shop drawings will be the Contractor's responsibility.

3.2. SUBMITTALS

Contractor shall provide the following submittal sections that apply to this project:

BASIC MATERIALS AND METHODS:

Test methods and data

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WIRING MEANS, METHODS, AND MATERIALS:

Conduits, Conductors and Cables, Outlet Pull and Junction Boxes, Tests and Data, Wall and Trench Duct, Cable Tray, Floor boxes

WIRING DEVICES AND SPECIALTIES:

Switches, Receptacles, and Cover Plates

ELECTRICAL DISTRIBUTION:

Switchboards, Panelboards, Fuses, Circuit Breakers, Transformers, Transient Voltage Surge Suppression

ELECTRICAL EQUIPMENT

Disconnect Switches, Motor Starters, Motors, Electric Heaters, Photoelectric Controls, Contactors, and Time Clocks

LUMINAIRES LAMPS AND BALLASTS

Luminaires, Lamps, and Ballasts

FIRE ALARM SYSTEM

Fire Alarm plans and devices, Area of Rescue Assistance devices

LIGHTNING PROTECTION SYSTEM

Lightning Protection System plans and devices

3.3. OPERATING AND MAINTENANCE INSTRUCTIONS (O & M MANUALS)

Submit with shop drawings of equipment, three sets of operating and maintenance instructions and parts lists for all items of equipment provided. Instructions shall be prepared by equipment manufacturer.

Keep in safe place, keys and wrenches furnished with equipment under this contract. Present to Owner and obtain receipt for same upon completion of project.

Prepare a complete brochure, covering systems and equipment provided and installed under his contract. Submit brochures to Architect/Engineer for review before delivery to Owner. Contractor at his option may prepare this brochure or retain an individual to prepare it for him. Include cost of this service in bid. Brochures shall contain following:

- Certified equipment drawings/or catalog data with equipment provided clearly marked as outlined under Section this specification.
- Complete installation, operating, maintenance instructions and parts lists for each item of equipment.
- Special emergency operating instructions with a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to various parts of system.
- Record Set Drawings: The Contractor shall mark up a set of contract documents during construction noting all changes and deviations including change orders. These will be delivered to Architect at end of the project. After the originals are changed to reflect the blue line set, a copy shall be included in the brochure.

Provide brochure bound in black vinyl three-ring binders with metal hinge. Reinforce binding edge of each sheet of loose-leaf type brochure to prevent tearing from continued usage. Clearly print on label insert of each brochure:

- Project name and address.
- Section of work covered by brochure, i.e., Electrical.

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3.4. CUTTING AND PATCHING

Contractor shall do cutting and patching of building materials required for installation of work herein specified. Cut no structural members without Architect's approval and in a manner approved by him.

Patching shall be by contractors of particular trade involved and shall meet approval of Architect.

Drilling and cutting of openings through building materials requires Architect's review and approval. Make openings in concrete with concrete hole saw or concrete drill. Use of star drill or air hammer for this work will not be permitted.

Damage of building finishes caused by installation of electrical equipment, fixtures, outlets and other electrical devices shall be repaired at Contractor's expense to approval of Architect.

3.5. SETTING, ADJUSTMENT AND EQUIPMENT SUPPORTS

Work shall include mounting, alignment and adjustment of systems and equipment. Set equipment level on adequate foundations and provide proper anchor bolts and isolation as shown or specified. Level, shim, and grout equipment bases as recommended by manufacturer. Mount motors, align and adjust drive shafts and belts according to manufacturer's instruction. Equipment failures resulting from improper installation or field alignment shall be repaired or replaced by Contractor at no cost to Owner.

Provide electrical floor mounted equipment with 3-1/2" high concrete bases unless shown or specified otherwise. Electrical contractor shall size all pads. General contractor shall form all pads, provide and place all concrete for said pads. Individual concrete pad shall be no less than 4" wider and 4" longer than equipment, and shall extend no less than 2" from each side of equipment.

Provide each piece of equipment or apparatus suspended from ceiling or mounted above floor level with suitable structural support, platform or carrier in accordance with best recognized practice. Electrical contractor shall arrange for attachment to building structure, unless otherwise indicated on drawings or as specified. Provide hangers with vibration eliminators where required. Contractor shall verify that structural members of building are adequate to support equipment. Submit details of hangers, platforms and supports together with total weights of mounted equipment to Architect/Engineer for review before proceeding with fabrication or installation.

Provide 3-1/2" high concrete housekeeping pad as specified above where two or more conduits penetrate floor below panelboards.

3.6. START-UP, CHANGE-OUT, TRAINING AND OPERATION CHECK

Electrical Contractor shall be responsible for training Owner's operating personnel to operate and maintain systems and equipment installed. Keep a record of training provided to Owner's personnel listing the date, subject covered, instructor's name, names of Owner's personnel attending and total hours of instruction given each individual.

All owner training sessions shall be orderly and well organized and shall be video taped using digital format. At the end of the owner training, the "training tape" shall become the property of the Owner.

3.7. FINAL CONSTRUCTION REVIEW

At final construction review, Electrical Contractor and the major sub-contractors shall be present or shall be represented by a person of authority. Each Contractor shall demonstrate, as directed by Architect/Engineer, that the work complies with purpose and intent of plans and specifications. Respective Contractor shall provide labor, services, instruments or tools necessary for such demonstrations and tests.

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**RELEASE FOR
CONSTRUCTION
AS NOTED ON PLANS REVIEW
DEVELOPMENT SERVICES
LEE'S SUMMIT, MISSOURI
Lee's Summit, MO
07/16/2020**

END OF SECTION 260100

SECTION 260500 - BASIC ELECTRICAL MATERIALS AND METHODS

1. PART 1 - GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2. PART 2 – PRODUCTS

Not Used

3. PART 3 - EXECUTION

3.1. IDENTIFICATION OF WIRING AND EQUIPMENT

Provide identification and warning signs to wiring and equipment as listed in schedule. Handwriting shall not be acceptable. Signs and tags shall be as follows:

- TYPE 1: Laminated phenolic plastic with black Gothic condensed lettering by Seton or Wilco.
- TYPE 2: Self-sticking ½" wide plastic tape with high gloss surface and embossed lettering by Brady, Seton or Dymo.
- TYPE 3: Self-sticking flexible vinyl with oil resistant adhesive for -20 degrees to 300 degrees F. temperatures by Brady, Seton or as approved.
- TYPE 4: Self-sticking polyester sign with wording and size conforming to ANSI Standard Z35.1-1964 and OSHA 19.0.144iii(2) Specifications, by Brady, Seton or as approved.

Provide lighting and power panelboards with Type 1 sign minimum of 1-1/4" x 6" indicating panel designation and electrical characteristics. Mount inside of panel door on circuit breaker trim flange just below breakers.

Provide disconnect switches, motor starters, time clocks, contactors and controllers, control panels, etc. with Type 1 sign ¾" x 5" indicating equipment served and "Warning Danger" sign.

Provide Type 2 tape at feeder terminal lugs to switchboards and panelboards. Tape shall indicate conduit size, conductor type and AWG size. Tape shall be located so as to be easily read with conductors installed.

Provide feeders and branch circuit home runs with Type 3 wire marker indicating circuit number and power source. Provide feeders phase identification letter at each terminal point in addition to its circuit number.

Provide electrical equipment and accessible wiring enclosures operating at voltage above 240 volts with Type 4 "Danger High Voltage" warning sign and voltage marker applied to front door or cover of device or enclosure. Provide large equipment such as transformers and main distribution equipment with Type 3 sign indicating all electrical characteristics.

Panels shall have branch circuit directory holders with clear plastic cover. Provide neatly typed list of branch circuit loads corresponding to branch circuit numbers.

All wires for branch circuit work shall be color coded.

3.2. NEUTRAL AND GROUND WIRES

Where individual circuit homeruns (hots, neutral, and ground as part of a single circuit) are indicated on the plans, these shall be individual circuits with individual neutrals and grounds (no sharing of neutrals and grounds).

Where shared circuit homeruns (hots, neutral, and ground as part of separate circuits) are indicated on the plans, these shall be allowed to share one (common) neutral for three (3) circuits from different phases occurring in one (1) conduit run. When additional circuits occur in conduit run, additional neutrals shall be installed. Conduit shall be upsized and conductors shall be de-rated based on NEC current carrying conductor tables counting all hots and neutrals as current carrying conductors.

3.3. TESTS RECORDING, REPORTING TESTS AND DATA

Record nameplate horsepower, amperes, volts, phase service factor and other necessary data on motors and other electrical equipment furnished and/or connected under this contract.

Record motor starter catalog number, size and rating and/or catalog number of thermal-overload units installed in all motor starters furnished and/or connected under this contract. See motor starter specification for instructions for proper sizing of thermal-overload units.

Record amperes-per-phase at normal or near-normal loading of each item of equipment furnished and/or connected.

Record correct readings of each feeder conductor after energized and normally loaded, and again after balancing of feeder loads as required by current readings.

Record voltage and ampere-per-phase readings taken at service entrance equipment after completion of project with building operating at normal electrical load.

Submit at least two (2) typewritten copies of data noted above to Architect-Engineer for review prior to final inspection.

Keep a record of all deviations made from routes, locations, circuiting, etc. shown on contract drawings. Prior to final inspection submit one new set of project drawings with all deviations and changes clearly indicated.

3.4. CLEANING AND PAINTING OF MATERIALS AND EQUIPMENT

Before energizing switchboards, transformers, panelboards, starters, variable frequency drive and other similar electrical equipment, Contractor shall thoroughly vacuum out all dirt, dust and debris from inside of equipment and shall thoroughly clean outside and inside of equipment.

Touch-up painting and refinishing of factory applied finishes shall be by Electrical Contractor. Contractor shall be responsible for obtaining proper type of painting materials and color from equipment manufacturer.

Unless specified otherwise factory built equipment shall be factory painted. Paint shall be applied over surfaces only after they have been properly cleaned and coated with a corrosion resistant primer.

After installation, damage to painted surfaces shall be properly prepared and primed with primers equal to factory materials. Finish coating shall be same color and type as factory finish.

Where extensive refinishing is required equipment shall be completely repainted.

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3.5. EXCAVATION AND BACKFILL

Perform necessary excavation to receive work. Provide necessary sheathing, shoring, cribbing, tarpaulins, etc. for this operation, and remove at completion of work. Perform excavation in accordance with appropriate section of these specifications, and in compliance with OSHA Safety Standards.

Excavate trenches of sufficient width to allow ample working space, and no deeper than necessary for installation work.

Conduct excavations so no walls or footings are disturbed or injured.

Backfill excavations made under or adjacent to footing with selected earth or sand and tamp to compaction required by A/E.

Mechanically tamp backfill under concrete and pavings in 6" layers to 95% standard density, Reference Division 2.

Backfill trenches and excavations to required heights with allowance made for settlement.

Tamp fill material thoroughly and moistened as required for specified compaction density.

Dispose of excess earth, rubble and debris as directed by Architect.

When available, refer to test hole information on architectural drawings or specifications for types of soil to be encountered in excavations.

3.6. FIRE BARRIERS

Provide sleeves through all fire-rated walls and fill voids surrounding sleeves and interior to sleeves around piping with Nelson "Flameseal" fire stop putty with U.L. listed 3 hour rating installed as per manufacturers recommendations.

Equivalent by Dow, Chemelex, 3M.

All holes or voids created by the electrical contractor to extend conduit or wiring through fire rated floors and walls shall be sealed with an intumescent material capable of expanding up to 8 to 10 times when exposed to temperatures of 250 degrees F. It shall have ICBO, BOCAI and SBCCI (NRB 243) approved ratings to 3 hours per ASTM E-814 (UL 1479). Acceptable Material: 3M Fire Barrier Caulk, Putty, Strip and sheet forms.

3.7. TEMPORARY COVERINGS

Provide temporary covering over all electrical panels, distribution panelboards, outlet boxes and other equipment as required to keep same free from damage due to moisture, plaster, paint, concrete or other foreign materials. Any equipment with finish damaged by moisture, paint, plaster or other foreign materials shall be cleaned and refinished as directed by the Architect without additional cost to the Owner.

All temporary openings in conduits shall be covered with metal or plastic caps.

END OF SECTION 260500

SECTION 262000 - WIRING MEANS, METHODS, AND MATERIALS

1. PART 1 - GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2. PART 2 – PRODUCTS

2.1. CONDUITS

All conduit delivered on the job shall be stored at least 12" above grade, roof, or floor. Keep the interior of all conduits clean. Conduits containing moisture or foreign material will not be accepted and shall be thoroughly cleaned and dried before installation.

2.1.1. Steel Conduit

Contractor may use either rigid steel or EMT for all main feeder circuits to switchboards and panelboards unless specifically indicated on plans.

2.1.2. Galvanized Rigid Steel Conduit

Conduit shall be hot dipped galvanized and shall bear a UL label. Conduit shall also meet Federal Specification W-WC-581 and ANSI C80.1.

2.1.3. EMT Conduit

Conduit shall be galvanized steel electrical metallic tubing and bear a UL label. Conduit shall conform to Federal Specification WWC-563 and ANSI specification C80.3.

2.1.4. Outside and Wet Location Flexible Conduit

Flexible conduit shall have a water resistant non-sleeving polyvinyl chloride jacket with a general temperature range of -40 degrees C to + 60 degrees C. Conduit shall bear a UL label.

2.1.5. BX Flexible Conduit

3/8" may only be used from JB to lighting fixture as per NEC 350. Other sizes shall be secured at 4-1/2 foot maximum intervals by mechanically fastening to structure. A ground wire shall be run in conduit. Contractor shall use flexible conduit for connections to motors and equipment mounted on resilient mounts or vibration isolators. Maximum length of flexible conduit shall be 8'-0".

2.1.6. MC Cable and Romex

MC cable and Romex are not allowed.

2.2. CONDUIT FITTINGS

Where conduits cross building expansion joints provide O-Z expansion fittings type "AX", "TE", "EX", or "EXE" as required.

Provide grounding bushings where feeder conduit attaches to panelboard backbox. Bond grounding bushing to ground bus.

2.2.1. Rigid Steel Conduit

Couplings shall be steel threaded type and box connectors shall be steel insulated bushings and malleable iron or steel locknuts. Unilets shall be malleable iron with blank cover.

2.2.2. EMT Conduit

Couplings and box connectors shall be die cast setscrew type. Unilets shall be malleable iron with blank cover.

West Pryor Lot 3

2.2.3. Flexible Conduit

Connectors shall be threaded type iron with insulated throat.

2.3. PLASTIC CONDUIT

Provide rigid polyvinyl chloride (PVC) type EPC 40 heavy wall plastic conduit meeting current NEMA Standard TC-2. Conduit shall be listed UL 651 for underground and exposed use.

Plastic conduit may only be used for exterior underground applications or circuits beneath slabs on grade. Provide galvanized rigid steel (GRS) radius bends and risers as conduits rise above grade or above floor slab.

Provide exterior underground conduit with metal detection strip.

Provide matching plastic fittings. Fittings shall meet the same standards and specifications as the conduit on which it is installed.

Joining and bending of conduit and installation of fittings shall be done only by methods recommended.

Provide conduit support spacing as recommended for the highest ambient temperature expected.

Provide interlocking conduit spacers for multiple runs of underground conduits installed in same trench.

Provide expansion couplings on long runs regardless of ambient temperatures. Determine amount of conduit expansion and contraction from published charts or tables.

Plastic conduit and fittings shall be by a Products Division of Continental Oil Company.

2.4. INSERTS, HANGERS

Support vertical and horizontal conduit runs at intervals not greater than 10 feet, within 3 feet of any bend and at every outlet or junction box.

Install multiple runs of conduits as follows:

- Where a number of conduits are to be run exposed and parallel, group and support with trapeze hangers.
- Fasten hanger rods to structural steel members with suitable beam clamps and to concrete structures with inserts set flush with surface. Install concrete inserts with reinforced rod through opening provided in inserts.
- Inserts shall be Grinnell figure 279, 281, 282, or 285 or equivalent as required by load and concrete thickness.
- Provide beam clamps suitable for structural members and conditions.
- Provide 3/8" minimum diameter steel hangers rods galvanized or cadmium plated finish.
- Trapeze hangers shall be Kindorf Series 900 channels with fittings and accessories as required.
- Attach each conduit to trapeze hanger with Steel City No. C-105 clamps for rigid conduit and Steel City No. C-106 clamps for electrical metallic tubing. (EMT).

Install clamps for single conduit runs as follows:

- Support individual runs by approved pipe straps, secured by toggle bolts on hollow masonry; expansion shields and machine screws or standard preset inserts on concrete or solid

masonry; machine screws or bolts on metal surfaces; and wood screws on wood construction.
Use of perforated strap not permitted.

- Install exposed conduits in damp locations with clamp backs under each conduit clamp to prevent accumulation of moisture around conduits.

Provide inserts, hangers and accessories with finish as follows:

- Galvanized: Concrete inserts and pipe straps.
- Galvanized or Cadmium Plated: Steel bolts, nuts, washers and screws.
- Painted with Prime Coat: Individual hangers, trapeze hangers and rods.

Equivalent hangers and support systems by Binkley, Fee and Mason, Kin-Line or Unistrut.

2.5. BUSHINGS AND LOCKNUTS

Enter outlet boxes squarely and securely clamp conduit to outlet box with bushing on inside and locknut on outside.

2.6. SLEEVES

Provide proper type and size sleeves to General Contractor for electrical ducts, busses, conduits, etc. passing through building construction. Supervise installation to insure proper sleeve location. Unless indicated or approved install no sleeves in structural members.

Provide cast iron sleeves extending 1 inch above finished floor where sleeves pass through floors subject to flooding such as toilet rooms, bathrooms, equipment rooms and kitchen. Seal opening between pipe and sleeve with Thunderline Corp. Link Seal.

Unless specified otherwise provide 18 gauge galvanized sheet metal sleeves through floors and non-bearing walls. Where piping passes through exterior walls, equipment room walls, air plenum walls and walls between areas that must be isolated from occupied areas, seal space between sleeves and piping, air or water tight are required with Thunderline Corp. Link Seal.

Provide O-Z Electrical Manufacturing Co., Inc. Type "FSK" or "WSK" or equivalent thruwall and floor seals where conduits pass through concrete foundation walls below grade.

Provide Zurn Z-195 or equivalent flashing sleeve through walls and floors with waterproof membrane. Seal annular space between conduit and sleeve with Thunderline Link Seal or O-Z type CSM sealing bushing.

All holes or voids created by the electrical contractor to extend pipe through fire rated floors and walls shall be sealed with an intumescent material capable of expanding up to 8 to 10 times when exposed to temperatures of 250 degrees F. It shall have ICBO, BOCAI and SBCCI (NRB 243) approved ratings to 3 hours per ASTM E-814 (UL 1479). Acceptable Material: 3M Fire Barrier Caulk, Putty, Strip and sheet forms.

2.7. CONDUCTORS

Provide conductors by Encore, Southwire, Senator, Cerro, or approved equivalent.

Unless noted otherwise conductors referred to are wires and cable. Provide code grade soft annealed copper conductors with specified insulation type in proper colors to conform with color coding specified. Provide conductors No. 8 gauge and larger stranded and conductors No. 10 gauge and smaller shall be solid.

Use no conductors smaller than No. 12 gauge unless specifically called for or approved by Engineer. Size wire for volt branch circuits for 3% maximum voltage drop. Size feeder circuits for

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2% maximum voltage drop. Combined voltage drop of feeders and branch circuits shall not exceed 5% maximum.

Provide conductors for listed applications as follows:

2.7.1. Lighting and Receptacle Circuits

Type THWN, or THWN/THHN 600 volt, 75 degrees C (167°F) thermoplastic insulated building conductor or better.

2.7.2. Lighting and Receptacles Circuits with No. 8 or larger conductors, motor circuits, power and feeder circuits and building service feeders

Type THHN/THWN 600 volts, 75 degrees C (167°F) thermoplastic insulated building conductor.

2.8. FIRE BARRIER

Provide sleeves through all fire-rated walls and fill voids surrounding sleeves and interior to sleeves around cables with Nelson "Flameseal" fire stop putty with U.L. listed 3 hour rating installed as per manufacturers recommendations.

Equivalent by Dow, Chemelex, 3M.

2.9. OUTLET BOXES

Provide electrical service outlets, including plug receptacles, lamp receptacles, lighting fixtures and switches with Steel City, Raco, or equivalent four inch code gauge steel knockout boxes galvanized or sheradized of required depth for service or device.

Provide code gauge galvanized steel raised covers on outlet boxes installed in plaster finish. Set to plaster grounds with outside edge of cover flush with plaster finish.

Provide 3/8" or larger fixture stud in each outlet box scheduled to receive lighting fixture. Select covers with proper opening for device installed in outlet box.

Use of utility of "Handy" boxes acceptable only where single gang flush outlet box in masonry is "dead-end" with only one conduit entering box from end or back.

Use no sectional outlet boxes.

Provide Appleton FS or FD unilets for surface mounted exterior work. Provide complete with proper device cover and gasket. Provide blank cover and gasket when used as junction box.

2.10. LOCATION OF OUTLET BOXES

Locate outlet boxes generally from column centers and finished wall lines. Install ceiling outlet boxes at suspended ceiling elevations.

Accurately locate lighting fixtures and appliance outlet boxes mounted in concrete or in plaster finish on concrete. Install outlet boxes in forms to dimensions taken from benchmarks, columns, walls, or floors. Rough-in lighting fixtures and appliance outlet boxes to general locations before installation of walls and furring and reset to exact dimensions as walls and furring are constructed. Set outlet boxes true to horizontal and vertical finish lines of building.

Install outlet boxes accessible. Provide outlet boxes above piping or ductwork with extension stems or offsets as required to clear piping and ductwork.

Install top of switch outlet boxes 48" above floor unless otherwise called for or required by wainscot, counter, etc. Install bottom of receptacle outlet boxes 16" above floor unless otherwise called for on drawings. Adjust mounting heights to nearest masonry joint for minimum cutting in case of flush outlets.

Install clock and other outlet boxes at elevations indicated on drawings or as directed by Architect.

Do not install outlet boxes "back to back" in walls and partitions.

2.11. PULL BOXES, WIREWAYS AND GUTTERS

Provide Alwalt, Keystone, Universal or equivalent code gauge pull boxes, wireways, and gutters indicated or required for installation, sized to conform with NEC rules. Provide complete with necessary fittings, interconnecting nipples, insulating bushings, conductor supports, covers, gaskets, partitions, etc. as required.

Special items may be fabricated locally, to same general design and specifications as those listed in specified manufacturer's catalogs. Provide free of burrs, sharp edges, unreamed holes, sharp pointed screws or bolts, and finished with one coat of suitable enamel inside and out, prior to mounting.

Provide sectional covers for easy removal.

3. PART 3 - EXECUTION

3.1. CONDUIT INSTALLATION

Align conduit terminations at panelboards, switchboards, motor control equipment, junction boxes, etc. and install true and plumb. Provide supports or templates to hold conduit alignment during rough-in stage of work.

Install conduit continuous between outlet boxes, cabinets and equipment. Make bends smooth and even without flattening or flaking conduit. Radius of bends shall not be shorter than radius listed table 346-10 (b) of NEC. Long radius elbows may be used where necessary.

Ream and clean conduit before installation and plug or cover openings and boxes to keep conduit clean during construction.

Install no conduits or other raceways sized smaller than permitted in applicable NEC Tables. Where conduit sizes shown on drawings are smaller than permitted by code, Contractor shall include cost for proper size conduit in his base bid. In no case reduce conduit sizes indicated on drawings or specified without written approval of Architect-Engineer. Fasten conduit securely in place with approved straps, hangers, and steel supports. Provide O-Z cable support to support conductors in vertical raceways as required by NEC Table 300-19 (a) of NEC.

PVC conduit installation: Make square saw cut with fine tooth saw. Debur and round inside edge of the cut end. Clean socket ID and spigot OD of dirt and moisture. Apply a uniform coat of cement to spigot end and push into socket bottom, rotating ¼ turn. Allow time to set before disturbing, this will vary with ambient temperature. Test workmanship by conducting a low-pressure air (3.0-5.0 psi) test after system is installed and cemented joints are set. Plug and block ends to prevent movement prior to pressurization. Check for leaks at all joints with a soap solution. Even low-pressure air can cause high thrust loads and caution must be observed. The test shall be observed by the architect, engineer or owner's representative, prior to backfill. All below grade conduit must be watertight.

Low voltage wiring including fire alarm, telephone, television, computer cabling and other low voltage wiring shall be installed in conduit unless noted otherwise.

3.2. CONDUCTOR INSTALLATION

Run conductors in conduit continuous between outlets and junction boxes with no splices or taps pulled into conduits.

West Pryor Lot 3

Neatly route, tie and support conductors terminating at switchboards, motor control centers, panelboards, sound equipment, etc., with Thomas & Betts Ty-Rap cable ties and clamps or equivalent by Electrovert or Panduit.

Make circuit conductor splices with Buchanan B series finger ease wire nuts or equivalent. Make fixture and device taps with Scotchlok self-stripping electrical tap connectors.

Terminate solid conductors at equipment terminal strips and other similar terminal points with insulated solderless terminal connectors. Terminate all stranded conductor terminal points with insulated solderless terminal connectors. Provide Thomas & Betts Sta-Kon insulated terminals and connectors or equivalent by API/AMP, Blackburn, Buchanan or Scotchlok "Wire Nuts".

One (common) neutral may be used for three (3) circuits from different phases occurring in one (1) conduit run. When additional circuits occur in conduit run, additional neutrals shall be installed.

Where a total of six or more control and feeder conductors terminate in a multiple device panel or enclosure that has no built-in terminal blocks provide Buchanan 600 volt heavy duty Type HO sectional terminal blocks with mounting channel and No. 23 see-thru covers. Equivalent terminal blocks by General Electric, Square D or Westinghouse.

Wrap conductor taps and connections requiring additional insulation with a minimum of three overlapped layers of 3M scotch vinyl plastic electrical type No. 88 or equivalent.

Install no conduits or wiring in air ducts, except that required to power devices that directly perform work upon air in the ductwork. No wiring shall be installed in any portion of grease ducts or airstreams of kitchen exhaust.

3.3. CONDUCTOR COLOR CODING

Provide continuous color coding for feeder, branch and control circuits. Insulation or identification tape color shall be same color for like circuits throughout. Where specified insulation colors are not available in larger wire sizes color code conductor at all accessible locations with Scotch 35 all-weather color code tape. Identify the same phase conductor with same color throughout.

Provide grounding conductors #6 and smaller with green insulation. Provide grounding conductors larger than #6 identified with green vinyl tape.

Provide conductors with color coding in accordance with NEC. Where more than one standard voltage system is installed provide similarly colored conductors with indicated tape or stripe to indicate system voltage.

In new construction provide conductor color coding as follows.

PHASE	120/208	120/240	277/480
A	BLACK	BLACK	BROWN
B	RED	RED	ORANGE
C	BLUE	BLUE	YELLOW
N	WHITE	WHITE	GRAY
GRD	GREEN W/WHT STRIPE	GREEN W/WHT STRIPE	GREEN W/ YLW STRIPE
ISOL. GRD	GREEN W/ORNG STRIPE	GREEN W/ORNG STRIPE	N/A

Provide an engraved phenolic placard inside each panel door indicating the conductor color code.

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**RELEASE FOR
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LEE'S SUMMIT, MISSOURI
Lee's Summit, MO
07/16/2020**

END OF SECTION 262000

West Pryor Lot 3

SECTION 263000 - WIRING DEVICES AND SPECIALTIES

1. PART 1 - GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2. PART 2 – PRODUCTS

Provide factory-fabricated wiring devices in types, colors, and electrical ratings for applications indicated. Wherever possible, devices shall be back and side wired. All switches and receptacles shall incorporate a metal mounting strap: non-metallic mounting straps are not acceptable. Switches shall be listed per UL 20 and certified by UL to Fed Spec. WS-596E. Receptacles shall be listed per UL 498 and certified by UL to Fed. Spec. WS-896E. Both switches and receptacles shall be visibly marked with the "UL-FS" mark to confirm certification. All devices shall be from the same manufacturer. Color of devices shall be Ivory.

2.1. SWITCHES, RECEPTACLES AND COVER PLATES

Provide where shown on plans Leviton wiring devices. Part numbers shall be as listed for each device specified. Equivalent devices by Bryant, Hubbell, General Electric, Arrow Hart, Pass & Seymour, Eagle.

2.1.1. INDUSTRY REFERENCES

Underwriter's Laboratories (UL)

Switches (UL 20)

Receptacles, Plugs & Connectors (UL 498)

Pin & Sleeve Connectors (UL 1286)

Device Plates (UL 514)

GFCI's (UL 943)

National Electric Manufacturers Association (NEMA)

WD-1 (Devices, Plates, Colors)

WD-6

Federal Specifications

Fed Spec Switches (WS-896E)

Fed Spec Receptacles (WC-596F)

Fed Spec Device Plates (W-P-455)

2.2. SWITCHES

2.2.1. Dimmer Switches

2000W incandescent dimming capacity.

Leviton Part No. #82000

2.2.2. Pilot Light Switches

Shall have illuminated toggles in the ON position for visual load monitoring.

Leviton Part No. #12-1-PLR

West Pryor Lot 3

2.2.3. Momentary contact switches

Shall be 20 ampere, double throw, three position, center off toggle switches mounted in matching wall plate.

Leviton #1257

2.2.4. Toggle switch schedule

TOGGLE SWITCHES						
TYPE	GE	AH	BRYANT	HUBBELL	LEVITON	P&S
Single Pole	GE5951-2G	1991I	4901-GI	HBL1221I	1221-2I	20AC1-I
Double Pole	GE5952-2G	1992I	4902-I	HBL1222I	1222-2I	20AC2-I
3-Way	GE5953-2G	1993I	4903-I	HBL1223I	1223-2I	20AC3-I
4-Way	GE5954-2G	1994I	4904-GI	HBL1224I	1224-2I	20AC4-I
SP Key Op	GE5951-OLG	1991L	4901-L	HBL1221L	1221-2L	20AC1-L
3-W Key Op	GE5953-OLG	1993L	4903-L	HBL1223L	1223-L	20AC3-L

2.3. RECEPTACLES

2.3.1. Receptacles

Standard receptacles shall be equipped with a 20 ampere simplex or duplex plug receptacles as shown on the plans except where otherwise noted. Receptacles shall be 3 wire grounding type NEMA No. 5-20R. Receptacle shall be constructed with Nylon face and base; .050 gauge brass backstrap with one-piece ground design; riveted self-grounding clip; and .040 gauge solid brass, triple-wipe contacts.

2.3.2. Emergency Receptacles

Receptacles denoted as "Emergency" shall be red in color, and denoted as such with a device plate labeled with the word "EMERGENCY" in capital letters.

2.3.3. Isolated Ground Receptacles

IG receptacles shall be 3 wire grounding type NEMA No. 5-20R-IG. Receptacle shall be constructed with Nylon face and base; .050 gauge brass nickel-plated backstrap with isolated ground design; riveted self-grounding clip; and .040 gauge solid brass, nickel-plated, triple-wipe contacts. Receptacles shall be orange.

2.3.4. Weatherproof receptacles

Weatherproof receptacles shall be equipped with a ground fault interrupter receptacle which will automatically detect a ground fault current and will de-energize receptacle when fault current exceeds 5 milliamps. GFCI shall be certified Class A by Underwriter's Laboratories.

Leviton #6898 with a hinged while in use weatherproof heavy duty cover.

2.3.5. GFCI Receptacles

GFCI receptacles shall detect a ground fault current and shall automatically de-energize receptacle when fault current exceeds 5 milliamps. GFCI shall be certified Class A by Underwriter's

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Laboratories, and listed under UL Standard 943. Receptacle shall be rated 20A. 120V. 2 pole, 3 wire grounding.

2.3.6. Combination 120/208 Volt Receptacles

Shall be 20 ampere duplex, NEMA 5-20R/6-20R.

Leviton #5844

2.3.7. Surge Suppression Receptacles

Surge Suppression receptacles shall be isolated ground, duplex receptacle design, rated 20 ampere, 120 Volts and shall contain surge suppression device to protect appliances served by the receptacle. Receptacles shall provide 13,000 Amps Maximum Surge Current Line to Neutral; 6,500 ampere Maximum Surge Current Line to Ground; and 6,500 ampere Max. Surge Current Neutral to Ground; each based on IEEE C62.41, * X 20 us waveform. Receptacle shall be certified by UL 1449 to have maximum clamping voltage of 500 Volts Peak Line to Neutral, Line to Ground, and Neutral to Ground based on Class B, 6KV, 3KA impulse, and shall be suitable for ANSI/IEEE C62.41-1980 installation categories A and B. Receptacles shall have a blue faceplate. Receptacle shall have an audible alarm.

Leviton #5380

Leviton #5380-IG (isolated ground)

Leviton #8380 (Hospital Grade)

Leviton #8380-IG (Hospital Grade w/ isolated ground)

2.3.8. Clock Outlets

Clock Outlets shall be equipped with recessed grounded receptacle mounted in a satin stainless steel plate.

Leviton #5261-CH

2.3.9. Tamper-Proof Receptacles

Tamper Proof Receptacles shall be safety type, "childproof," duplex, 3 wire, ground type rated 15 amperes at 125 volts.

Leviton #5262-SG

2.3.10. Corrosion-Resistant Receptacles

Corrosion-Resistant receptacles shall be provided with a 20 ampere, 125 Volt duplex receptacle, NEMA 5-20R configuration. It shall be constructed with Nylon face and base; .050 gauge brass nickel-plated backstrap with one-piece ground design; riveted self-grounding clip; and .040 gauge solid brass, nickel-plated, triple-wipe contacts. Face shall be yellow in color. Device shall surpass ASTM-B-17-13, 500 Hour salt spray and fog test requirements with no visible corrosion.

Leviton #53CM-62

2.3.11. Four-In-One receptacles

Shall be installed where shown on plans. Product shall be manufactured in conformance with IEC 309-1 and 309-2, with an IP67 rating. Products shall also carry a UL1286 listing.

2.3.12. Commercial Spec Grade Receptacle Schedule:

RECEPTACLES							
TYPE	GE	AH	BRYANT	HUBBELL	LEVITON	EAGLE	P&S
Duplex	GE5362-2	5362I	5362-I	5352I	5352-I	5362V	5362-I

Simplex	GE4102-2	5361I	5361-I	5351I	5351-I	5361V	5361-I
Isolated Ground	GE5362-IG2	IG5362I	5362-IGI	IG5352I	5352-IGI	IG5362V	IG600-I
GFCI	GE5342-2G	GF5342I	GFR53FT-I	GF5352-IA	6898-I	647-2V	2091-IS
Weather-proof				GF5352-GYA	6898		
TVSS w/IG				IG5362S	5380-IG		

2.3.13. Industrial Heavy Duty Spec Grade Receptacle Schedule:
Receptacles shall be by Hubbell or Leviton only.

RECEPTACLES		
TYPE	HUBBELL	LEVITON
Duplex	5362I	5362-I
Simplex	5361I	5361-I
Isolated Ground	IG5362I	5362-IGI
GFCI	GF5352IA	6898-I
Weatherproof	GF5352GYA	6898
TVSS w/IG	IG5362S	5380-IG

2.3.14. Special Purpose Devices

Provide where indicated or specified. Refer to following list for description for special purpose devices.

A NEMA 6-20R receptacle:

20A, 250V, 2 pole, 3 wire grounding, side and back wired, single; ivory; Leviton #5461-I.

B NEMA 5-30R receptacle:

30A, 125V, 2 pole, 3 wire grounding, single; black; Leviton #5371.

C NEMA 6-30R receptacle:

30A, 250V, 2 pole, 3 wire grounding, single; black; Leviton #5372.

D NEMA 10-30R receptacle:

30A, 125/250V, 3 pole, 3 wire, 1 phase, single; brown; Leviton #5207.

E NEMA 14-30R receptacle:

30A, 125/250V, 3 pole, 4 wire, 1 phase grounding, single; black; Leviton #278.

F NEMA 15-30R receptacle:

30A, 250V, 3 pole, 4 wire, 3 phase, grounding, single; black; Leviton #8430-A.

G NEMA 6-50R receptacle:

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50A, 250V, 2 pole, 3 wire, 1 phase, grounding, single; black; Leviton #5374.

H NEMA 10-50R receptacle:

50A, 125/250V, 3 pole, 3 wire, 1 phase, black; Leviton #5206.

I NEMA 14-50R receptacle:

50A, 125/250V, 3 pole, 4 wire, 1 phase, grounding, single; black; Leviton #279.

J NEMA L6-20R receptacle:

20A, 250V, 2 pole, 3 wire, 1 phase, grounding, single, locking type; black; Leviton #2320.

K NEMA L5-30R receptacle:

30A, 125V, 2 pole, 3 wire, 1 phase, grounding, single, locking type; black; Leviton #2610.

L NEMA L6-30R receptacle:

30A, 250V, 2 pole, 3 wire, 1 phase grounding, single, locking type, black; Leviton #2620.

M NEMA L15-30R receptacle:

30A, 250V, 3 pole, 4 wire, 3 phase, grounding, single, locking type, black; Leviton #2720.

2.3.15. Architectural Style Specification Grade Devices

Devices shall be used where indicated on plans. Devices shall be Leviton "Decora Plus" with matching screwless, Lexan plates. Switches shall be 20 ampere, 277 volt rated. Receptacles shall be NEMA 5-20R configuration, 20 ampere, 125 volt.

2.4. SWITCH AND RECEPTACLE FLUSH WALL PLATES

Wall plates for all flush outlets shall be satin stainless steel Type 302. All plates shall be listed per UL 514 and shall be of the same manufacturer as the devices furnished. Plates for surface mounted device outlets shall be drawn galvanized steel for steel boxes and cast for cast boxes.

Provide projecting mounted wiring devices with standard stainless steel wall plates with satin finish conforming to U.S. Bureau of Standards finish #32D.

Provide matching blank wall plates to cover outlet or junction boxes intended for future devices.

Provide matching blank wall plates with round knock out at all telephone outlet locations.

Provide factory engraved wall plates where indicated. Where engraved text is not outlined submit two copies of proposed text to A/E for review.

Where wall plates for special devices are available only from manufacturer of device, provide designs and finishes equivalent to above specification.

Verify with Architect finish of any plate where it may be apparent a special finish or color should have been specified.

Multiple switch plates shall be engraved to indicate what they control.

3. PART 3 - EXECUTION

Install wiring devices to manufacturer's recommendations and in strict accordance with applicable sections of NEC.

Wall plates shall not support wiring devices. Provide wiring device with accessories as required to properly install devices and wall plates.

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END OF SECTION 263000

**RELEASE FOR
CONSTRUCTION
AS NOTED ON PLANS REVIEW
DEVELOPMENT SERVICES
LEE'S SUMMIT, MISSOURI
Lee's Summit, MO
07/16/2020**

SECTION 264000 - ELECTRICAL DISTRIBUTION

1. PART 1 - GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2. PART 2 – PRODUCTS

2.1. DISTRIBUTION SWITCHBOARD

Provide dead front type, metal enclosed, indoor switchboard arranged for service as indicated by schedules.

Equivalents by Square D, G.E., Cutler Hammer, and ITE Siemens.

Switchboards shall be designed and tested in accordance with current applicable IEEE, ANSI Standards and equipped with the devices built in accordance with latest UL, NEC and NEMA standards. Mount switchboard on 3-1/2" high concrete base. Each switchboard, as a complete unit, shall be given a single short circuit current integrated equipment rating (IER) by the manufacturer. Such ratings shall be established by the actual tests by the manufacture, in accordance with UL specifications, on equipment constructed similarly to the subject switchboard. Integrated equipment ratings shall be as indicated on the schedules.

Switchboard shall be free standing construction with front accessibility required. Provide the appropriate number of vertical sections bolted together to form one metal enclosed rigid switchboard with sides, top and rear be covered with removable screw-on code gauge steel panels. Steel base channels shall be bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting. Provide wiring gutter space in accordance with NEC. Top and bottom conduit areas shall be clearly indicated on shop drawings.

The switchboard bussing shall be of sufficient cross-sectional area to meet UL Standard 891 temperature rise. Vertical and horizontal through bus shall be tin-plated copper. The through bus supports, connections and joints are to be bolted with hex-head bolts and Belleville washers to minimize maintenance requirements and shall have provisions for the addition of future sections. Bus bar connection to branch circuit shall be "Phase Sequenced" type designed and assembled so that branch circuit devices can be removed without disturbing adjacent devices or removing main bus. Wire lugs for main bus shall be solderless, anti-turn, front removable type suitable for copper conductors. Provide each panel with grounding bus sized per UL 891, grounded to box and grounding system. Also provide full capacity neutral bus insulated from switchboard.

2.1.1. OVERCURRENT PROTECTION AND BRANCH DEVICES

A MAIN OVERCURRENT PROTECTION DEVICE

The main device shall be a [Electronic trip molded case full function 100% rated circuit breaker][Electronic trip molded case standard function 80% rated circuit breaker(s)][Thermal magnetic molded case circuit breaker(s)][fused bolted pressure switch][Fusible Switch]

B GROUND FAULT PROTECTION SYSTEMS

The ground fault system shall require no external power to trip the device. The ground fault sensing system shall be suitable for use on grounded systems. The ground fault sensing system shall be suitable for use on three-phase, three-wire circuits where the system neutral is grounded but not carried through the system or on three-phase, four-wire systems. Ground fault pickup current setting and time delay shall be field adjustable. A switch shall be provided for setting

West Pryor Lot 3

ground fault pickup point. A means to seal the pickup and delay adjustments shall be provided. The ground fault sensing system shall include a Ground Fault memory circuit to sum the time increments of intermittent arcing ground faults above the pickup point. A means of testing the ground fault system to meet the on-site testing requirements of NEC Section 230-95© shall be provided. Local visual ground fault trip indication shall be provided.

C FUSIBLE BRANCH CIRCUIT SWITCHES

The switchboard group-mounted fusible branch devices are to be totally front accessible and front connectable. The fusible switch connections to the distribution panel bussing shall be of a "blow-on" design such that the connections grip the bus bars firmly under high-fault conditions.

D CIRCUIT BREAKER BRANCH CIRCUIT DEVICES

Branch circuit devices shall be [Electronic trip molded case full function 100% rated circuit breaker(s)][Electronic trip molded case standard function 80%ratedcircuitbreaker(s)][Thermal magnetic molded case circuit breaker(s)]

E THERMAL-MAGNETIC CIRCUIT BREAKERS

Circuit breakers shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole. Thermal trip elements shall be factory preset and sealed. Circuit breakers shall be true rms sensing and thermally responsive to protect circuit conductor(s) in a 40° C ambient temperature.

F ELECTRONIC TRIP CIRCUIT BREAKERS

Circuit breaker trip system shall be a microprocessor-based true rms sensing design with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the schedules and drawings. The integral trip system shall be independent of any external power source and shall contain no less than industrial grade electronic components. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and adjustment positions shall be clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 80-100% of their ampere rating continuously as specified.

The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent of all other adjustments.

Long Time Pickup, Instantaneous Pickup, Long Time Delay Ground Fault Pickup, Short Time Pickup, Ground Fault Delay, Short Time Delay

A means to seal the trip unit adjustments in accordance with NEC Section 240-6(b) shall be provided.

Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.

2.1.2. Schedules

See plans for schedules of switchboard layout. Provide switchboard with protective devices and equipment as listed on schedule.

Provide 3 ½" housekeeping pad when equipment is floor/ground mounted.

2.2. PANELBOARDS

Provide panelboards as indicated in the panelboard schedule and where shown on the plans. Panelboards shall be equipped with fusible switches or thermal-magnetic, molded case circuit breakers as indicated on the schedules.

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Equivalents by Square D, G.E., Cutler Hammer or ITE Siemens.

2.2.1. BUSSING ASSEMBLY AND TEMPERATURE RISE:

Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 50 degrees C rise above ambient. Heat rise tests shall be conducted in accordance with Underwriters Laboratories Standard UL 67.

Provide tin-finished copper bars full length of panel with rating listed in schedule. Bus bar connection to branch circuit breakers shall be "Phase Sequence" type designed and assembled so circuit breakers can be replaced without disturbing adjacent breakers or removing main bus or branch circuit connectors. Provide bus bars with wire lugs suitable for copper or aluminum conductors. Provide each panel with equipment tin finished copper grounding bus grounded to box and tin finished copper neutral bus insulated from box.

2.2.2. INTEGRATED EQUIPMENT SHORT CIRCUIT RATING

Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating as indicated in the schedules. This rating shall be established by testing with the overcurrent devices mounted in the panelboard. The short circuit tests on the overcurrent devices and on the panelboard structure shall be made simultaneously by connecting the fault to each overcurrent device with the panelboard connected to its rated voltage source. Method of testing shall be per Underwriters Laboratories Standard UL 67. The source shall be capable of supplying the specified panelboard short circuit current or greater. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

2.2.3. CABINET

Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67. Provide branch circuit panelboard cabinets with latch and tumbler-type lock on door of trim. Doors over 48" long shall be equipped with three-point latch and vault lock. All locks shall be keyed alike. Endwalls shall be removable. Fronts shall be of code gauge steel. Gray baked enamel finish electrodeposited over cleaned phosphatized steel. Fusible panelboards and large distribution circuit breaker panelboards shall not be provided with doors.

2.2.4. SAFETY BARRIERS

The panelboard interior assembly shall be dead front type with panelboard front removed. Main lugs or main breakers shall have barriers on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers.

2.2.5. UL LISTING

Panelboards shall be listed by Underwriters Laboratories and shall bear the UL label. When required, panelboards shall be suitable for use as service equipment.

2.2.6. OVERCURRENT PROTECTION AND BRANCH DEVICES

A BRANCH CIRCUIT BREAKERS

Branch circuit breakers shall be quick-make, quick-break with trip indication. Circuit breakers shall operate both manually for normal switch functions and automatically under overload and short circuit conditions. They shall provide circuit and self-protection when applied within their rating. Operating mechanisms shall be entirely trip free so that contacts cannot be held closed against a short circuit. Operating handle of circuit breaker shall open and close all poles of a multipole

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breaker simultaneously. Conforming to NEMA Standards Publications No. AB1-1964 and be approved by UL. Circuit breaker shall have a thermal magnetic trip unit for each pole for inverse time delayed overload protection and an instantaneous magnetic element for short circuit protection. Multiple pole trip elements shall operate a common internally connected trip bar to open all poles in case of overload or short circuit through any one pole.

B FUSIBLE SWITCHES

The fusible switches shall be horsepower rated, quick-make, quick-break and shall be mounted in panel-type construction. Switches shall have plug-on side connections and shall have built in fuse pullers. Each switch is to be contained in a separate steel enclosure. The enclosure will employ a hinged cover for access to the fuses which will be interlocked with the operating handle to prevent opening the cover when the switch is in the "on" position. This interlock shall be constructed so that it can be released with a standard electrician's tool for testing fuses without interrupting service. The units shall have padlocking provisions in the "off" position, i.e., red for "on" and black for "off". Fusible switch units shall be interchangeable without disturbing adjacent units and be properly supported to prevent vibration and breakage during shipment and handling.

Fuse holders shall be high-pressure type for use with Class R fuses. Main switch fuse holder shall be set up for use with UL Class R fuses. Provide rejection clips for fuse holders where rejection type fuses are called for or shown.

2.3. INSTALLATION

Provide 3½" housekeeping pad where two or more conduits penetrate floor or when equipment is floor/ground mounted.

Panels shall have branch circuit directory holders with clear plastic cover. Provide neatly typed list of branch circuit loads corresponding to branch circuit numbers.

Provide panelboards labeled for voltage, phase, and ampacity.

2.4. OVERCURRENT PROTECTIVE DEVICES

2.4.1. FUSES

Provide fuses by Bussman or Gould Shawmut.

Provide fuses of same characteristics as scheduled to insure selective coordination of power system.

Install fuses only after installation is complete and final tests and inspections have been made. Label fuses, switches and other fused devices with warning labels affixed in prominent location indicating type and size of fuse installed and fuse manufacturer's catalog number.

Fuses 601 amp and larger shall be U/L Class L with minimum four (4) seconds time delay at 500% rating.

Fuses 600 amp and below shall be U/L Class J, RK-1 or RK-5 as scheduled time delay sized as shown on drawings or schedules.

Special temperature conditions, motors, motor loads or other conditions requiring other types or sizes of fuses must be reviewed by the Contracting Officer. Fuse reducers are not permitted.

Furnish Owner with spare fuses of each size and type installed on job as follows:

- 601 Amps or Larger - three (3) of each size and type
- 600 Amps or Less - 10% with minimum of three (3) of each size and type

For fuse types and ampacities, see plans.

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Provide spare fuse cabinet with three shelves.

2.4.2. CIRCUIT BREAKERS

Provide circuit breakers by Square D, G.E., Cutler Hammer or ITE Siemens.

Circuit breakers shall be quick-make, quick-break with trip indication. Circuit breakers shall operate both manually for normal switch functions and automatically under overload and short circuit conditions. They shall provide circuit and self-protection when applied within their rating. Operating mechanisms shall be entirely trip free so that contacts cannot be held closed against a short circuit. Operating handle of circuit breaker shall open and close all poles of a multipole breaker simultaneously. Conforming to NEMA Standards Publications No. AB1-1964 and be approved by UL. Circuit breaker shall have a thermal magnetic trip unit for each pole for inverse time delayed overload protection and an instantaneous magnetic element for short circuit protection. Multiple pole trip elements shall operate a common internally connected trip bar to open all poles in case of overload or short circuit through any one pole.

2.5. GROUNDING

Supplement grounded neutral of secondary distribution system with equipment grounding system, installed so that metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, portable equipment and other conductive items operate continuously at ground potential and provide low impedance path for ground fault currents.

System shall comply with National Electrical Code, drawings and as specified.

2.5.1. GROUND RODS

Ground rods shall be minimum $\frac{3}{4}$ " diameter by 10'-0" long copper rods.

2.5.2. SERVICE GROUNDS

Provide equipment ground bus in base of low voltage, switchgear brazed or otherwise adequately connected by an approved method to ground rods. Where required, to meet requirement so specified tests, extra rods shall be installed at no additional cost to Owner. Rods shall be located no closer than 6 feet from each other or any other electrode and shall be interconnected by a bare copper conductor brazed to each ground rod below grade.

Provide in conduit a green insulated copper ground conductor to main metallic water service entrance and connect by means of adequate ground clamps. Where a dielectric main water fitting is installed, connect ground conductor to building side of dielectric water fittings. Jumper across dielectric union. Bond conduit to ground conductor at each end. Provide jumper with ground clamps around dielectric main water fitting.

2.5.3. BONDING

Connect system neutral ground and equipment ground system to common ground bus. Ground secondary services at supply side of each individual secondary disconnecting means and at related transformers in accordance with National Electric Code. Provide each service disconnect enclosure with neutral disconnecting means which interconnects with insulated neutral and uninsulated equipment ground sub to establish system common ground point. Neutral disconnecting links shall be located so that low voltage neutral bar with interior secondary neutrals can be isolated from common ground bus and service entrance conductors.

2.5.4. EQUIPMENT

Equipment grounding conductors for branch circuit home runs shown on the drawings shall indicate an individual and separate ground conductor for that branch circuit which shall be terminated at the branch circuit panelboard, switchboard, or other distribution equipment. No

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sharing of equipment grounding conductors sized according to the size of the overcurrent device and NEC Table 250-95 shall be allowed.

Required equipment grounding conductors and straps shall be sized in compliance with N.E.C. Table 250-95. Equipment grounding conductors shall be provided with green type TW 600 volt insulation. Related feeder and branch circuit grounding conductors shall be connected to ground bus with approved pressure connectors. Provide feeder servicing several panelboards with a continuous grounding conductor connected to each related panelboard ground bus. Installation shall include necessary precautions regarding terminations with dissimilar metals.

2.5.5. CIRCUITING

Provide low voltage distribution system with a separate green insulated equipment grounding conductor for each single or three-phase feeder. Single phase 120 volt branch circuits for lighting and power shall consist of phase and neutral conductors and a green ground conductor installed in common metallic conduit which shall serve as grounding conductor. Provide flexible metallic conduit utilized in conjunction with above single phase branch circuits with suitable green insulated grounding conductors connected to approved grounding terminals at each end of flexible conduit. Single phase branch circuit installed in nonmetallic conduits shall be provided with separate grounding conductor. Install grounding conductor in common conduit with related phase and/or neutral conductors. Where parallel feeders are installed in more than one raceway, each raceway shall have a green insulated equipment grounding conductor.

2.5.6. GROUNDING PROVISIONS

Contractor shall determine number and size of pressure connectors to be provided on equipment grounding bars for termination of equipment grounding conductors in panelboards and other electrical equipment. In addition to active circuits, provide pressure connectors for panel spares and blank spaces.

2.5.7. OTHER REQUIREMENTS

Provide electrical expansion fitting with an external flexible copper ground securely bonded by approved grounding straps on each end of fitting except where UL approved built-in copper grounding device is provided.

Provide steel and aluminum conduits which terminate without mechanical connection to metallic housing of electrical equipment with ground busing and connect each bushing with bare copper conductor to ground bus in electrical equipment. Electrically non-continuous metallic conduits containing ground wiring only shall be bonded to ground wire at both conduit entrance and exit.

Grounding conductors shall be as shown on plans or if not specifically shown shall be no smaller than that required by the NEC.

2.5.8. GROUNDING TEST

Test complete equipment grounding system at each service disconnect enclosure ground bar with Vibroground test unit manufactured by Associated Research Inc. Resistance, without chemical treatment or other artificial means shall not exceed fifteen (15) ohms to ground.

Electrical Contractor shall oversee grounding tests at successful completion of installation of grounding system and shall submit certified test reports of ground tests to A/E.

2.6. TRANSIENT VOLTAGE SURGE SUPPRESSION

Provide transient voltage surge suppression units as hereinafter specified by a single manufacturer. The Contractor shall furnish and install the Transient Voltage Surge Suppression

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(TVSS) equipment having the electrical characteristics, ratings and modifications as specified herein and as shown on the contract drawings.

Transient Voltage Surge Suppression (TVSS) equipment shall be Cutler-Hammer type Clipper Power Systems (CPS) or approved equal meeting all ratings and features specified herein.

Equivalents by: Current Technology, Inc., Advance Protection Technologies, LEA Dynatech, Liebert, Hubbell, Cutler-Hammer, Square D, or Leviton.

The TVSS units and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of the following:

UL Listed under UL 1449 and UL 1283

CSA certified per CSA 22.2

The UL 1449 2nd Edition suppression voltage ratings (SVR) and CSA label shall be permanently affixed to the TVSS unit.

Provide verification that the TVSS device complies with the required UL 1449 2nd Edition clamp voltage documentation and UL 1283 SVR.

Provide test report from a recognized independent testing laboratory verifying the suppressor components can survive published surge current rating on both a per mode and per phase basis using the IEEE C62.41, 8 x 20 microsecond current wave. Note that test data on individual module is not accepted.

Unit Operating Voltage -- Refer to drawings for operating voltage and unit configuration.

Maximum Continuous Operating Voltage (MCOV) -- The MCOV shall be greater than 115% of the nominal system operating voltage.

Protection Modes -- For a wye-configured system, the device must have directly connected suppression elements between line-neutral (L-N), line-ground (L-G), and neutral-ground (N-G). For a delta-configured system, the device must have suppression elements between line to line (L-L) and line to ground (L-G).

Balanced Suppression Platform -- The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating TVSS modules which do not provide a balanced impedance path to each MOV shall not be acceptable.

Electrical Noise Filter -- Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be 55 dB at 100 kHz using the MIL-STD-220A insertion loss test method. The unit shall be complimentary listed to UL 1283. Products not able to demonstrate noise attenuation of 55 dB @ 100 kHz shall be rejected.

Internal Connections -- No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be hardwired with connections utilizing low impedance conductors and compression fittings.

Safety and Diagnostic Monitoring -- Each unit shall be equipped with 200 kAIC internal fuses. Each unit shall provide the following three levels of monitoring:

Continuous monitoring of fusing system

Internal infrared sensor system for monitoring individual MOVs (including neutral to ground). The system must be capable of identifying open circuit failures not monitored by conventional fusing systems.

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Thermal detection circuit shall monitor for overheating in all modes due to thermal runaway.

A green/red solid state indicator light shall be provided on each phase. The absence of a green light and the presence of a red light, shall indicate which phase(s) have been damaged. Fault detection will activate a flashing trouble light. Units which can not detect open-circuit damage, thermal conditions and over current will not be accepted.

Warranty -- The manufacturer shall provide a minimum five (5) year warranty from the date of shipment against any TVSS part failure when installed in compliance with manufacturer's written instructions and any applicable national or local electric code.

VSS devices shall be mounted such that they are seismically qualified for UBC and California Building Code Zone 4 applications.

The unit must be equipped with transient event counter and audible alarm.

Remote Status Monitor -- The TVSS device must include form C dry contacts (one NO and one NC) for remote annunciation of unit status. The remote alarm shall change state if any of the three monitoring systems described detect a fault condition.

Push-To-Test Feature -- Each suppression unit shall incorporate an integral test feature which verifies the operational integrity of the unit's monitoring system.

2.6.1. SYSTEM APPLICATION

The TVSS applications covered under this section include distribution and branch panel locations, bus plugs, motor control centers (MCC), switchgear, and switchboard assemblies. The branch panel located TVSS shall be tested and demonstrate they are suitable for ANSI/IEEE C62.41 Category C1 environments.

Surge Current Capacity -- The minimum total surge current 8 x 20 microsecond waveform that the device is capable of withstanding shall be as shown in the following table:

<u>Application</u>	Min. Surge	
	<u>Current Per Phase</u>	<u>Current Per Mode*</u>
Service Entrance (Switchboards		
Switchgear, MCC Main Entrance)	250 kA	125 kA
Distribution Panelboards	160 kA	80 kA
High Exposure Roof Top Locations	160 kA	80 kA
Branch Locations (Panelboards, MCC's, Busway)	120 kA	60 kA
*L-G, L-N and N-G (WYE system); L-L, L-G (Delta system)		

CLAMPING VOLTAGES

OPERATING VOLTAGE	L-N	L-G	N-G	L-L	MCOV
120/208	400/500	400/500	400	800	150
120/240	400/500	400/500	400	800	150
277/480	800/1000	800/1000	800	1500	200

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2.6.2. DISTRIBUTION PANEL PROTECTION UNIT

A INTERNAL CONNECTIONS

All internal wiring associated with the suppression/filter system and subject to surge currents shall utilize low-impedance copper bus bar and/or #4 AWG copper conductor or larger. All internal connections associated with the suppression/filter system and subject to surge currents shall be made with compression solderless-type lugs and shall be bolted to the bus bars in order to reduce overall system impedance. No plug-in component modules, quick-disconnect terminals or printed circuit boards shall be used in surge current-carrying paths.

B FIELD CONNECTIONS

The unit shall include mechanical lugs for each phase, neutral and ground, if applicable. The lugs shall accommodate up to #4 AWG copper conductor with integral fused disconnect switch and up to 1/0 AWG copper conductor without integral fused disconnect switch.

C FIELD INSTALLATION

The unit shall be installed as close as practical to the distribution panel wiring system in accordance with applicable national/local electrical codes and the manufacturer's recommended installation instructions. Connection shall be with #4 AWG copper conductor or larger and shall be as short as possible, avoiding unnecessary bends.

D ENCLOSURE

Standard surface-mounted units shall be provided in a NEMA 1 type enclosure of 14 gauge steel, painted inside and out in a neutral color or to match the panelboards.

2.6.3. ELECTRONIC GRADE PANELBOARD

A TRIM

In general, panelboard interiors, enclosures, circuit breakers, etc., shall be as specified under: PANELBOARDS. The unit shall have a removable interior. The interior shall be so arranged that individual branch circuit breakers may be installed or removed without disturbing adjacent units, bus structure or insulation. The unit shall include an all copper main bus of the ampacity and arrangement as indicated on the drawings. The unit shall include bolt-on main, branch or sub-feed circuit breakers with frame size, poles, trip rating and minimum interrupting rating as indicated on the drawings.

B 200% RATED COPPER NEUTRAL BUS

The unit shall include a 200% rated all copper neutral bus designed for the peculiar current demands associated with non-linear loads. The neutral bus shall include AL/CU rated mechanical solderless-type lugs in sufficient quantity and capacity as indicated on the drawings.

C SAFETY GROUND BUS

The unit shall include a safety ground bus with connection points equal to the number of branch breaker positions. The safety ground bus shall include AL/CU rated mechanical solderless-type lugs in sufficient quantity and capacity as indicated on the drawings.

D INSULATED ISOLATED GROUND BUS

The unit shall include an insulated isolated ground bus with connection points equal to the number of branch breaker positions. The insulated isolated ground bus shall include AL/CU rated mechanical solderless-type lugs in sufficient quantity and capacity as indicated on the drawings.

E FIELD CONNECTIONS

The unit shall include mechanical solderless-type connection points and labels for each phase, neutral, safety ground and insulated isolated ground as indicated on the drawings.

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F WIRING GUTTERS

The unit shall have an all-around interior perimeter wiring gutter. The cross sectional dimension of the gutter shall be as required by national/local electrical codes.

G IDENTIFICATION

The unit shall include manufacturer's nameplate and UL inspection labels on interior of cabinet.

H INTEGRAL CIRCUIT BREAKER FOR SUPPRESSION/FILTER SYSTEM

The unit shall require an integral circuit breaker as a means of disconnecting the suppression/filter system for maintenance and/or test purposes without interruption of power to the facility's distribution system. The breaker shall be 120/208.

I SUPPRESSION/FILTER SYSTEM CONNECTIONS

All internal wiring associated with the suppression/filter system and subject to surge currents shall utilize low-impedance copper bus bar and/or #8 AWG copper conductor or larger. All internal connections associated with the suppression/filter system and subject to surge currents shall be made with compression solderless-type lugs and shall be bolted to the bus bars in order to reduce overall system impedance. No plug-in component modules, quick-disconnect terminals or printed circuit boards shall be used in surge current-carrying paths.

J INTEGRAL TEST POINT

The unit shall incorporate an integral test point allowing easy off-line diagnostic testing which verifies the operational integrity of the unit's suppression/filter system.

K ACCESSORIES

i REMOTE STATUS MONITOR CONTACTS

The unit shall include Form C dry contacts (N.O. or N.C.) to facilitate connection to a building management system in order to monitor the on-line status of the unit. The contacts shall be normally open or normally closed and shall close or open upon failure of the suppression system and/or fuse. Coordinate contact arrangements with building management contractor.

ii DIAGNOSTIC TEST SET

A Diagnostic Test Set shall be provided which verifies the operational integrity of the unit's suppression system. The Diagnostic Test Set shall be self-contained and portable and shall provide complete assurance of the unit's installation and capability without stressing the suppression system or posing detriment to continued operation.

2.7. METERING EQUIPMENT

2.7.1. COMMERCIAL METERING EQUIPMENT

MULTI-METERING shall be furnished floor mounted and wall attached at locations as shown on the drawings.

Metering shall be UL listed. Panelboards identified for use as service equipment are to be labeled for this application. Coordinate with local utility.

Meter Units shall be EZ Meter Pak by Square D Company. Equivalent by G.E., I.T.E., Cutler Hammer.

2.7.2. ENCLOSURES

Enclosures shall be constructed of formed and welded code gauge galvanized steel NEMA Type 3R with baked enamel finish electrodeposited over cleaned phosphatized steel.

No device disassembly is to be required before mounting.

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All devices must be bonded together with bolted connections.

All compartments containing un-metered circuits shall be provided with a sealing means.

2.7.3. INTERIOR CONSTRUCTION

All components except for branch plug-in units shall be factory assembled and all current carrying parts shall be plated bus bars.

Individual units shall be constructed with an integral sliding one bolt joint-pak assembly for a completely bussed meter center. This single bolt is to be a VISI-TITE bolt for tightening without a torque wrench.

Meter Sockets shall be 7 jaw, 200A or 400A as shown on the drawings.

Sockets shall be rated 200 or 320 ampere continuous duty.

Meter sockets shall be field installable through 200A.

2.7.4. BRANCH MOLDED CASE CIRCUIT BREAKERS

Circuit breakers shall be thermal magnetic trip, with an integral crossbar to provide simultaneous opening of all poles in multi-pole circuit breakers.

Breakers shall have an overcenter, tripfree, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication.

Handles shall have "ON" and "OFF" and "Tripped" positions.

Circuit breakers shall be UL listed in accordance with UL standard 489 with current ratings as noted on the plans. Interrupting ratings shall be selected to provide the required short circuit current rating.

2.7.5. SHORT CIRCUIT CURRENT RATING

65,000 ampere rms symmetrical short circuit current ratings shall be provided. This rating shall be established by manufacturer testing of a representative meter center with branch overcurrent devices installed.

3. PART 3 - EXECUTION

All Electrical Distribution equipment shall be cleaned and free of all construction debris. Install units as shown and detailed on the plans and per manufacturers directions.

See plans for equipment schedules.

END OF SECTION 264000

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SECTION 265000 - ELECTRICAL EQUIPMENT

1. PART 1 - GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

2. PART 2 – PRODUCTS

2.1. DISCONNECT SWITCHES

Provide heavy-duty horsepower rated Safety Switches rated in accordance with NEMA enclosed Switch Standard KS 1-1969 and L98 Standard.

Equivalents by: G.E., Cutler Hammer, or I.T.E. Siemens, or Square D.

Enclosure shall be NEMA type required by switch location and environment. Enclosure door shall latch with means for padlocking and cover interlock with defeater to prevent opening door when switch is energized or closing switch with door open. Switch shall have an embossed nameplate permanently attached to door front with switch rating, short circuit interrupting capacity and application information.

Line terminals shall be permanently marked and shielded. Contact shall be tin plated, equipped with arch chutes and have movable contacts visible in off position with door open. Wiring terminals shall be pressure type suitable for copper or aluminum wire. Switching mechanism shall be quick-make, quick-break spring driven anti-tease mechanism and shall be integral part of box. All current carrying parts shall be plated.

Fuse holders shall be high pressure suitable for use with dual element fuses or rejection type current limiting fuses where required. Fuse holders shall be completely accessible from front of switch and fuses shall be installed so that the label may be easily read from the front and without removing the fuse.

All fuse holders shall have rejection clips installed.

All disconnect switches as specified shall be installed in strict accordance with rules set forth by NEC.

2.2. MOTORS

Motors shall be installed in strict accordance with rules set forth by NEC and equipment manufacturer.

2.2.1. ELECTRIC MOTORS (Less than ½ HP)

Motors 1/3 horsepower and smaller shall be selected by manufacturer of driven equipment with motor speed and torque characteristics best suited for application.

Motors shall have a minimum service factor of 1.15 for open dripproof enclosure and 1.00 for totally enclosed motors. Wherever applicable provide motors with cushion bases. Motor enclosure shall be proper type required for operating environment.

Motors shall have a plus or minus 10% voltage tolerance and plus or minus 5% frequency tolerance. Motors shall operate satisfactorily in ambient temperature range of 0 degrees C (32°F) to 140°C (104°F) at altitudes below 3300 feet.

Provide motors with built-in thermal overload protection. Motors readily accessible to operating personnel shall have manual reset protector. All other shall have automatic reset protectors.

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Motors shall have AFBMA standard double-shielded ball bearings sized for average life of at least 100,000 hours under normal loading conditions. Bearings housing shall have provisions for adding new lubricant without major disassembly and shall have seals to prevent entrance of foreign matter and leakage of bearing lubricant.

Motor bolts, screws and other external hardware shall be treated with corrosion resistant plating and motor enclosure prime painted with corrosion resistant metal primer finished with a durable machinery enamel.

Unless indicated otherwise motors shall be rated for continuous operation at 115, 200, or 277 volt single phase 60 hertz. Where equipment manufacturer offers a choice provide permanent split capacitor motors in lieu of shaded pole motors.

Motor leads shall be marked throughout entire length for easy identification and terminate with brass or copper terminal lugs. Motor shall have permanently attached nameplate with electrical characteristics and wiring connection diagram.

2.2.2. ELECTRIC MOTORS (1/2 HP and Larger)

Provide equipment requiring electric motors with NEMA Standard motors. Shop drawings, submitted and equipment provided with electric motors shall include motor manufacturer, horsepower, voltage, full load amperes, NEMA design type, insulation class, shaft bearing type, mounting base type, and enclosure type. To greatest extent possible motors for this project shall be by one manufacturer.

Motors shall conform to current NEMA Standard MG1. Motor shall operate successfully without derating under the following conditions.

40 degrees C (104°F) maximum ambient temperature, 3,300 Ft. maximum altitude, voltage variations of plus or minus 10% of nameplate rating, frequency variations of plus or minus 5% of nameplate rating, combined voltage and frequency variation of plus or minus 10% total as long as frequency does not exceed plus or minus 5%.

Motors shall meet or exceed locked rotor (Starting) and breakdown (maximum) torques specified for the NEMA design rating. Lock rotor currents shall not exceed NEMA maximum values for motor NEMA design rating.

Motor service factors shall be 1.15 for open dripproof motors and 1.00 for totally enclosed motors.

Unless indicated otherwise, motor insulation may be manufacturers standard for Class A, B or F provided that maximum permissible temperature for insulation is not exceeded when motor is operating at its service factor load in a 40 Degrees C (104°F) ambient.

Motor frame/HP relationship shall conform to current NEMA Standard for "T" frames. Motors shall have antifriction ball or roller bearings sized for average life of at least 100,000 hours under normal v-belt loading conditions. Bearings shall be AFBMA Standard and shield mounted ball bearings of ample capacity for motor rating. Bearing housing shall have provisions for adding new lubricant and draining out old lubricant without major motor disassembly. Bearing housing shall have seals to protect bearing from entrance of foreign matter and to prevent leakage of bearing lubricant.

Conduit box mounting shall rotate to allow conduit entrance from top, bottom or either side. Conduit holes shall conform to NEC Standards.

Motor leads shall have same insulation class as motor windings. Leads shall be marked throughout entire length for easy identification and terminated with brass or copper terminal lugs. Motor shall have permanently attached nameplate with electrical characteristics and wiring connection diagram.

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Motor bolts, screws and other external hardware shall be treated with a corrosion resistant plating. Motor enclosure shall be prime painted with corrosion resisting metal primer and finished with a durable machinery enamel.

Unless indicted otherwise motors shall be rated for continuous operation at rated voltage, three phase, 60 hertz. Motors shall be T-frame squirrel cage induction. Type NEMA design B with Class B insulation. Motors shall be dripproof totally enclosed or explosion-proof as required by motor environment.

2.3. CAPACITORS

Provide capacitors as indicated on the motor starter schedule. Capacitors shall be coordinated with each respective equipment manufacturer as to rating, correction achieved, and wiring. Motor power factor value desired is 95%. Verify final selection with Mechanical Contractor.

Manufacturers shall recommend heater sizing on starters feeding motors with capacitors. Provide contactors where required for proper operation.

Connect capacitors between starter and motor for non-jogging duty motors and between disconnect and starter for jogging duty.

2.4. ELECTRIC HEATERS

Provide electric heaters complete by single manufacturer.

Equivalents by: Berko, Qmark, Markel, Trane or approved equal.

2.4.1. ELECTRIC UNIT HEATERS

Furnish and install type horizontal/vertical unit heaters with heating and air delivery capacities as shown on the heating schedule.

The cabinet shall be made of steel. Individual adjustable louvers with downward stops shall be furnished to provide desired control of discharge air. All metal surfaces of the enclosure shall be phosphate coated to resist corrosion and finished in a decorative baked enamel. Mounting brackets designed for either ceiling or wall swivel mounting shall be furnished as shown on the heating schedule. Heaters shall be of the draw-through air flow design to eliminate the element hot spots and extend design life.

Fans shall be aluminum, directly connected to fan motor, and designed specifically for unit heater application.

Low voltage control 24 volt transformers shall be standard on models 7.5 KW and greater (Optional 120V), to allow safer more precise temperature control.

Individual optional field installable control kits shall be available for all models. All controls shall have pig tails and spade terminals for ease of wiring to centrally located terminal board. All heaters of 63 amperes or less shall be provided with power disconnect switches (field installed kits or factory installed).

All heaters shall be UL listed and meet the requirements of the National Electrical Code.

For safety, the electric heating bank shall consist of metal sheath heating elements. The elements shall consist of 80/20 Nichrome wire and have a copper clad steel sheath for strength and corrosion resistance, and aluminum fins for faster heat transfer. Automatic reset thermal overload protection shall be of the linear capillary type wired for instantaneous de-energizing in case of the thermal overload. Heating bank to have protective air inlet louvers.

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Motors shall be totally enclosed, designed for continuous heavy-duty all-angle operation and equipped with built-in thermal overload protection. Motors used on 25 thru 50 KW models shall be rated for two-speed operation.

2.4.2. EXPLOSION PROOF ELECTRIC UNIT HEATERS

The unit heater(s) shall be Underwriters Laboratories Inc. Listed for continuous use in Class I, Group D and Class II, Group E, F and G, Divisions 1 and 2 Hazardous Areas, and shall be rated for UL & National Electric Code Temperature Code T3B, 329 F (165 C).

Heat Exchanger: The Heat Exchanger shall be a liquid to air type consisting of steel tubes with rolled, furnace brazed fins and be finished with high temperature corrosion resistant aluminum paint. It shall operate at a normal pressure between 20 and 25 psig and be protected by a pressure relief valve and factory hydrotested at a pressure of 350 psig. It shall have an integral thermodynamically induced circulation system to increase the heat transfer from the fluid to the finned tubes. It shall be filled to design level with a blended, glycol and water solution including inhibitors to provide superior corrosion protection. It shall include a heavy-duty flanged immersion heater consisting of seamless copper heating elements brazed into a heavy steel flange. The elements shall consist of high quality resistance wire imbedded in a magnesium oxide refractory. The element assembly must be field removable and replaceable without the need to dismount the heat exchanger. The heater is to be protected by two quick acting linear high temperature limit cutouts. The primary limit will be an automatic type to shut off the heater if the fluid temperature rises due to a lack of heat dissipation. The back-up manual reset control will shut off the heater in case of low liquid level condition, which will cause the heater element temperature to rise above normal operating temperature. It shall include fill and drain ports to allow replacement of heat transfer fluid.

Fan and Motor Assembly: The fan assembly shall include a ball bearing, permanently lubricated, thermally protected explosion proof motor rated for continuous duty at 104° F. Fan shall be aluminum to prevent sparking and epoxy coated to prevent corrosion. It shall be directly connected to the motor, dynamically balanced, and designed specifically for the heater application. It shall be equipped with a combination heavy-duty chrome plated guard, shock mounted at four points to absorb any motor vibration.

Control Center: This component to include the following items completely factory prewired and tested, and enclosed in a NEMA 7 and 9 explosion-proof control enclosure mounted on the side of the heater cabinet it shall include a magnetic contactor sized to handle heater and motor, and shall be rated for 500,000 cycles operation. The encapsulated severe duty coil shall be rated 24V heater voltage and the secondary to be 24V. It shall include motor branch circuit fuses mounted into a heavy-duty fuse block. It shall include a warning service light to indicate abnormal operation, with a self-test feature to verify the light's condition when cycled through the thermostat circuit. The control center control circuit transformer shall be provided with primary fuse protection. The control center shall include a terminal block for remote thermostat connection.

Cabinet Assembly: The cabinet assembly to be fabricated from heavy gauge steel with epoxy coating for protection from corrosive atmospheres. It shall include steel frame to bear the weight of heat exchanger assembly with mounting holes located on the top. It shall be removable for inspection and cleaning of the heat exchanger assembly by removal of four metal fasteners.

2.4.3. CABINET ELECTRIC UNIT HEATERS

Heater shall be UL approved. Capacity, voltage, physical size, and options shall be as specified in the heater schedule. Provide built-in tamper resistant thermostat.

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The cabinet shall be of heavy-duty 16 gauge cold-rolled steel bar grille in brown baked enamel finish. The heater front panel shall be easily removable for access to elements, motor-blower assembly, and all internal components.

Thermal safety cutouts shall be built into the system to automatically shut-off heater in event of overheating due to any cause. The safety cutouts shall directly interrupt power to the elements and not depend on relays to interrupt the power.

The motor and blower shall be direct drive and resiliently mounted on a rigid heavy gauge frame for quiet operation and long life.

Fan control shall be bi-metallic snap-action type and shall activate fan after heating elements reach operating temperature, and continue to operate fan after the thermostat is satisfied and until heating elements are cool.

2.4.4. BASEBOARD ELECTRIC HEATERS

Provide where indicated on plans, electric baseboard heaters suitable for continuous operation. Heaters shall be UL listed.

Enclosure: The heaters shall be fabricated of minimum .028 inch steel with minimum .040 inch steel control boxes. Support brackets shall be 18 ga.

Front Cover: The front cover shall be fabricated of minimum 18 ga. steel.

Heating Element: The heating element wire shall consist of 80% nickel, 20% chromium, and shall be encased in steel sheath to assure long and trouble free life. Aluminum fins shall be so designed as to block sheath radiation to front and back of heater body and pressure bonded to steel sheath.

General: Linear thermal cutout shall be factory installed to automatically shut off heater in event of overheating and reactivate heater when temperature returns to normal. Raceway cover kit for providing an enclosed raceway is standard. The complete heater shall have a height of 6 ¾" and a depth of 2 ½". Heaters shall have UL approval for mounting on any floor surface including carpeting.

2.5. PHOTOELECTRIC CONTROLS, LIGHTING CONTACTOR AND TIME CLOCKS

Provide photoelectric controls, contactors, time clocks and all other necessary enclosures and accessories to provide a lighting control system.

2.5.1. PHOTOELECTRIC CONTROL

Equivalents by: Provide time clocks by Tork, Intermatic, or Paragon

Provide Tork series 2100 photoelectric control in locations indicated on drawings. Unit enclosure shall be die cast zinc, gasketed for weatherproofing and shall have positioning lug on top of enclosure. Cell shall be 1" diameter cadmium sulfide, capacity shall be 2000 watts tungsten at 120, 240 or 277 volt. Contacts shall be SPST normally closed snap action type. Unit shall be fully warranted for a minimum of 5 years.

2.5.2. LIGHTING CONTACTORS

Equivalents by: Asco, G.E., Square D, Cutler Hammer, I.T.E. Siemens

The contactor shall switch loads at the required voltages and shall have number of poles as required by drawings. The contactor shall be continuously rated 30 amperes per pole for all types of ballast and tungsten lighting, resistance and motor loads, unless otherwise called for on the drawings. The contactor shall have totally enclosed, double-break silver-cadmium-oxide power contacts. Auxiliary arcing contacts are not acceptable. Contact inspection and replacement shall be possible without disturbing line or load wiring. The contactor shall have straight-through wiring with all terminals clearly marked. The contactor shall be approved per UL508 and/or CSA, and be

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designed in accordance with NEMA ICS2-211B. They shall be industrial-duty rated for applications to 600 volts maximum.

The contactor shall have provisions for factory or field addition of:

Four (4) N.O. or N.C. auxiliary contacts rated 6 amperes continuous at 600 volts.

Single or double circuit, N.O. or N.C., 30 or 60 ampere 600 volt power-pole adder.

Control-circuit fuse holder, one or two fuses.

0.2-60 second TDE or TDD timer attachment.

Transient-suppression module for control circuit of 120 volts.

The contactor shall have a NEMA Type 1 enclosure.

Provide manual override switch.

2.5.3. MECHANICAL TIME CLOCKS

Time Switch shall be TORK Model W220L or equal.

Furnish and install where shown Time Clock of the 7 day type, powered by a self-starting synchronous motor, capable of being set for different ON-OFF times each day of the week, to an operating accuracy of plus or minus 15 minutes of the desired time. Time Switch contacts shall be capable of switching 40 amperes per pole continuously at 120/277 volts and shall be DPDT. Removable ON-OFF trippers shall make possible a minimum ON period of one hour and a minimum of 2 hours between one OFF operation and the next ON. Separate manual ON and OFF levers shall enable operation by hand without disturbing automatic settings. Enclosure shall be NEMA 1 surface type. NEMA 1 enclosure shall be finished in baked epoxy enamel, with combination $\frac{1}{2}$ " - $\frac{3}{4}$ " knock-outs on sides. Provision shall be made for positive padlocking and/or sealing. Terminals shall be capable of receiving #8 AWG wire. Spring-driven reserve shall be provided sufficient to operate the Time Switch contacts at least 24 hours after power failure. On restoration of power, Time Switch shall transfer to synchronous motor driven and automatically rewind reserve.

2.5.4. ELECTRONIC TIME CLOCKS

Provide Tork E-100 series electronic time clock or equal.

Provide where shown Time Clock with 24 hour, 7-day operation and minimum 14 set points. Provide unit with battery backup using 9V battery to be contractor supplied. Unit shall have LCD display, AM/PM operation and display, with contacts rated for 20A ballast at 120V and shall be SPST. Provide unit in NEMA 1 enclosure.

3. PART 3 - EXECUTION

All Electrical equipment shall be cleaned and free of all construction debris. Install units as shown and detailed on the plans and per manufacturers directions.

END OF SECTION 265000

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SECTION 266000 - LUMINAIRES, LAMPS AND BALLASTS

1. PART 1 - GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2. INSPECTION

Prior to installation of luminaires Electrical Contractor shall inspect luminaire and verify unit meets or exceeds specifications, is new and unused without damage or defect and is suitable for the intended service.

See architectural and electrical plans for luminaire locations, coordinate installation with other trades. At the completion of the project all luminaires shall be aligned, level and cleaned to the satisfaction of the A/E.

1.3. EQUIVALENT MANUFACTURERS

The following light fixture manufacturers are generally approved equals to those manufacturers listed in the Lighting Fixture Schedule on the drawings. The approval herein no way relieves the contractor of meeting all specification requirements. All light fixtures substituted for fixtures specified on drawings must conform in materials, dimensions, appearance, performance, and be of equal quality to the fixture specified and described in the Lighting Fixture Schedule. Fixture manufacturers not listed here must be submitted and approved a minimum of 10 days prior to bid.

Provide luminaires by the following manufacturers:

1.3.1. Downlights:

Category 1: (Only Category 1 fixtures may be substituted for Category 1 fixtures specified on the drawings). Edison Price, Kirlin, Kurt Versen, Rambusch

Category 2: (Category 1 or Category 2 fixtures may be substituted for Category 2 fixtures specified on the drawings). Halo, Hubbell, Indy, Infinity, Lightolier, Lithonia, Prescolite, Staff, Marko

1.3.2. Fluorescents: Williams, Lithonia, Columbia, Cooper (Metalux), Midwest Chandelier, Daybrite

Equivalent troffers shall be considered the following: Williams (50 Series), Lithonia (SP Series), Columbia (PS Series), Cooper (Metalux GC Series), Midwest Chandelier (Prestige Series), Daybrite (DG Series)

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- 1.3.3. Undercounter: Alkco, Columbia, Lithonia, Nulite, Williams
- 1.3.4. Strip Fluorescents: Columbia, Lithonia, Williams
- 1.3.5. Linear/Tubes: Corelite, Linear Lighting, Lite Control, Metalumen, Peerless, Precision, Zumtobel
- 1.3.6. Specialty Lights: Bega, Design Plan, Juno, Justice Design, Kramer, Louis Poulson, Lighting Services Inc., Neoray, Prudential, Sharper, Staff Manning, Sterner, Trend Lighting, Trimblehouse, Visa, Winona, Zaneen, Zumtobel
- 1.3.7. Indirect: Elliptipar, Engineered Lighting Products, SPI, Zumtobel
- 1.3.8. HID: G.E., Holophane, Hubbell, Kim, Lithonia, SPI
- 1.3.9. Exit Signs and Emergency Lights: Chloride, Concealite, Devine, Emergi-Lite, Hubbell, Lithonia, Prescolite, Surelites. Exitronix, Fail-Safe, Dual-Lite
- 1.3.10. Security/Vandal Resistant: Failsafe, Kenall, Kirlin, Holcor, L.C. Doane, Moldcast
Hazardous Locations: Appleton, Chloride, Cross-Hinds, Dual-Lite, Guth, Halo, Hubbell, Kirlin
- 1.3.11. Outdoor: Antique Street Lights, Architectural Area Lighting, Bega, Beta, Devine, Gardco, G.E., Hadco, Hubbell, Holophane, Hydrel, Kim, Lithonia, LSI Lighting Systems, Lumark, Lumec, McGraw-Edison, McPhilben, Ruud, Sterner, Sun Valley Lighting.
- 1.3.12. Track Lighting: Halo, Lithonia, Marko, Prescolite

2. PART 2 – PRODUCTS

2.1. LUMINAIRES

Provide luminaires complete with lamps and accessories required for hanging. Contractor shall insure that lamps, reflector lens and trim are clean at time of final inspection. Mount recessed luminaires with trim flush to ceilings, free of gaps or cracks.

Coordinate mounting of ceiling mounted luminaires with General Contractor. Where additional supports are required due to luminaire location or weight, electrical contractor shall provide supports, unless otherwise specified under ceiling specifications.

Consult architectural plans for ceiling types and provide surface and recessed lighting fixtures with appropriate mounting components and accessories.

Provide luminaires with the following devices wherever possible and not specified otherwise on the luminaire schedule: cam latches, 100% door gasketing, post fabrication painted finish, t-bar clips, lens clips, suspension tabs, and a minimum of 0.125" lens.

2.2. LAMPS

Lamps shall be lamp types recommended by luminaire manufacturer. Lamp no fixtures above manufacturers recommended maximum wattages.

Incandescent lamps shall be inside frosted (IF) type unless otherwise called for in luminaire schedule.

Provide fluorescent lamps as 32watt, T-8, with a Color Rendition Index (CRI) of no less than 75 and a color temperature of 4100 degrees K., 2900 approximate initial lumens unless otherwise called for in the luminaire schedule. Straight and U-tube fluorescent lamps shall comply with EPA TCLP(Toxic Characteristic Leaching Procedure) for mercury at the end of life.

Equivalent lamps by General Electric, Venture, Phillips or Sylvania.

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2.3. FLUORESCENT BALLASTS

Provide luminaires with ballasts as specified herein. Equivalent ballasts by Advance, Motorola, Magnetek.

2.3.1. ELECTRONIC FLUORESCENT INSTANT START

1-4 Lamp Parallel Circuit Ballasts shall have Independent Lamp Operation (ILO), allowing remaining lamps to maintain full light output if one or more lamps fail.

Ballasts shall operate from 60 Hz input source of 120, 277 Volts, and sustained variations of $\pm 10\%$ voltage and frequency with no damage to the ballasts. Intellivolt models shall operate from a line voltage range of 108-305 volts, 50/60 Hz.

Ballasts shall be a high frequency electronic type and operate lamps at a frequency above 42kHz to avoid interference with Infrared devices.

Lamp Current Crest Factor (ratio of peak to RMS current) shall be 1.7 or less in accordance with lamp manufacturer recommendations.

All ballast shall comply with ANSI C82.11 where applicable.

Ballasts shall tolerate operation of up to 70°C case temperature without damage.

Ballasts shall comply with FCC Part 18 Non-Consumer Equipment, Class A for EMI conducted and radiated.

Ballasts shall provide transient immunity as recommended by ANSI C62.41

Ballasts shall operate lamps with no visible flicker (<3% flicker index).

Ballasts shall tolerate sustained open circuit and short circuit output conditions without damage.

Normal Light Output Ballast shall have a minimum Ballast Factor of 0.88 for primary lamp applications per ANSI C82.11

Ballast Factor for Low Watt models shall be 0.75 minimum.

Ballast factor for High Light Output shall be 1.2 for primary lamp applications.

Input current Total Harmonic Distortion (THD) shall not exceed 20% or 10% as indicated on the luminaire schedule.

Ballasts shall have a Power Factor greater than .98 for primary lamp applications.

Ballast shall have a Class A+ sound rating.

Lamps may be remote or tandem mounted up to a maximum of 20 ft. overall lead length between ballasts and lamps. Consult factory for specific details.

Ballast shall be provided with integral leads, color coded to ANSI standard C82.11

2.3.2. ELECTRONIC FLUORESCENT PROGRAMMED RAPID START

Ballasts (1-4 lamp) shall operate as a series or series parallel circuit.

Ballasts shall operate from 60 Hz input source of 120, 277 Volts, and sustained variations of $\pm 10\%$ (Voltage & Frequency) with no damage to the ballasts. Intellivolt models shall operate from a line voltage range of 108-305 volts, 50/60 Hz.

Ballasts shall be a high frequency electronic type and operate lamps at a frequency above 42kHz to avoid interference with Infrared devices.

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Lamp Current Crest Factor (ratio of peak to RMS current) shall be 1.7 or less in accordance with lamp manufacturer recommendation.

All ballasts shall comply with ANSI C82.11 where applicable.

Ballasts shall tolerate operation of up to 70°C case temperature without damage.

Ballasts shall comply with FCC Part 18 Non-Consumer Equipment, Class A for EMI conducted and radiated.

Ballasts shall provide transient immunity as recommended by ANSI C62.41.

Ballasts shall operate lamps with no visible flicker (<3% flicker index).

Ballasts shall tolerate sustained open circuit and short circuit output conditions without damage.

Ballast factor for T8 lamps shall be a minimum of 0.88 for primary lamp applications. Ballast factor for T5 and T5HO shall be 1.00 for primary lamp, per ANSI C82.11.

Input current Total Harmonic Distortion (THD) shall not exceed 20% (for Standard models) and shall not exceed 10% (for Centium® models) for the primary lamp applications.

Ballast shall have a power factor greater than 0.98 for primary lamp applications.

Ballast shall have a Class A+ sound rating.

Ballast shall have a minimum starting temperature of 0°F for T5HO and T8 lamps and -20°F for T8HO).

2.4. FLUORESCENT ELECTRONIC DIMMING BALLASTS

INCLUDING: Continuous Line Voltage and Low Voltage (0-10) operated systems for linear and compact fluorescent lamps.

Ballast shall be Programmed Rapid Start.

Ballasts shall operate from 50/60Hz input source of 120, 277 Volts, and sustained variations of \pm 10% voltage and frequency with no damage to the ballasts.

Ballasts shall be a high frequency electronic type, and operate lamps above 42 kHz to avoid interference with infrared devices.

Lamp Current Crest Factor (ratio of peak to RMS current) shall be 1.6 or less throughout dimming range in accordance with lamp manufacturer recommendation.

All ballast shall comply with ANSI C82.11 where applicable.

Ballasts shall tolerate operation of 70°C case temperature without damage.

Ballasts shall comply with FCC Part 18 Non-Consumer Equipment, Class A for EMI conducted and radiated and shall provide transient immunity as recommended by ANSI C62.41

Ballasts shall operate lamps with no visible flicker (<3% flicker index).

Ballasts shall tolerate sustained open circuit and short circuit output conditions without damage.

Low Voltage Control dimming ballasts (0-10 volt) shall control lamp light output from a ballast factor range of .88 - .05 (100% to 5% of relative light output).

Powerline Control dimming ballasts shall control lamp light output from a ballast factor range of 1.0 - .05 (100% to 5% of relative light output).

Input current Total Harmonic Distortion shall not exceed 10% for the primary lamp.

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Ballasts shall have a power factor > 98% at full light output, and > 90% throughout dimming range.

Ballast shall have a Class A+ sound rating.

Ballast shall have an end of lamp life detection and shut-down circuit that meets ANSI/IEC standards for T4 & T5 models.

Ballast shall ignite the lamps at any light output setting selected without first having to go to full light output.

2.5. ELECTRONIC COMPACT FLUORESCENT

Ballast shall be Programmed Rapid Start.

Ballasts shall operate from 50/60 Hz input source of 108 through 305 Volts, and sustained variations of $\pm 10\%$ (Voltage & Frequency) with no damage to the ballasts.

Ballasts shall be a high frequency electronic type, and operate lamps at a frequency above 42 kHz to minimize interference with infrared control systems.

Lamp Current Crest Factor (ratio of peak to RMS current) shall be 1.7 or less in accordance with lamp manufacturer recommendation.

All ballast shall comply with ANSI C82.11 where applicable.

Ballasts shall comply with FCC Part 18 Non-Consumer Equipment, Class A for EMI conducted and radiated and shall provide transient immunity as recommended by ANSI C62.41.

Ballasts shall operate lamps with no visible flicker (<3% flicker index).

Ballasts shall tolerate sustained open and short circuit output conditions without damage.

Ballast shall have a minimum Ballast factor of 0.93 for 13 watt through 42-watt T4 & T5 compact fluorescent lamps.

Input current Total Harmonic Distortion shall not exceed 10% for the primary lamp.

Ballasts shall have a Power Factor greater than .96. Ballast shall have a Class A+ sound rating.

Ballast shall incorporate lamp shutdown circuitry for end of lamp life protection

Ballast shall allow for re-lamping without the need to cycle power

Ballast shall have a minimum starting temperature of 0° Fahrenheit.

Ballast shall be available in a hybrid can or all metal can construction to meet all plenum requirements and to eliminate the need for extra grounding wires.

Ballast shall be furnished with poke-in wire trap connectors, color-coded to ANSI C82.11 where applicable.

2.6. FLUORESCENT ELECTRONIC BALLAST SCHEDULE

Fluorescent electronic ballasts shall meet the requirements set forth in the following table.

Ballast Type	# Lamps	Lamp Type	Minimum Ballast Factor	Max. %THD	Sound Rating	Min. Power Factor
Instant Start	1,2,3,4	Straight/U	0.88	20	A+	.98
Rapid Start	1,2,3,4	Straight/U	0.88	20	A+	.98

Rapid Start	1,2	Compact	0.93	20	A+	.96
Dimmable	1,2,3,4	Straight/U	0.88-0.05	15	A+	.95
Dimmable	1,2	Compact	1.00-0.05	15	A+	.95

2.7. COLD WEATHER BALLASTS

Ballast for exterior lighting or in areas where luminaires are required to operate below 50 degrees F (i.e., coolers and freezers) shall have ballasts designed for low ambient operation. Low ambient fluorescent fixtures shall utilize Advance Mark V.

2.8. EMERGENCY BATTERY PACKS

Emergency battery packs shall be nickel cadmium battery, charger board, and electronic circuit enclosed in a steel case. Fluorescent battery packs shall provide approximately 1200 initial lumens from one lamp for 90 minutes. Units shall be U.L. listed and rated for operation interior or exterior to luminaire. Provide 5-year warranty. Battery packs shall be Bodine B-50 or Iota I-80. Equivalent by Lithonia.

3. PART 3 - EXECUTION

3.1. LUMINAIRES

All light fixtures shall be cleaned and free of all construction debris. Install units as shown and detailed on the plans and per manufacturers' directions.

Reference luminaire schedule on plans for specific luminaire, lamp, and ballast requirements.

Luminaires submitted must meet or exceed specified luminaire in performance and construction and appearance. Provide luminaires at each location shown on drawings. Luminaires shall be in accordance with type designation on drawings.

Luminaire supports shall comply with the latest edition of the NEC Sections 410-15 and 410-16. Provide luminaire securing clips as required or securely fasten fixtures to ceiling grid. At least two support wires shall be connected from the structure above to the ceiling grid at each troffer style light fixture.

3.2. BALLASTS

The ballasts shall not contain any PCB's (Polychlorinated Biphenyl).

The manufacturer shall provide written warranty against defects in material or workmanship, including replacement, for five years from date of manufacture.

Manufacturer shall have been manufacturing electronic ballasts and HID ballasts for at least ten years.

Ballasts shall provide instant starting sequence consistent with ANSI standard C82.11 for instant start applications.

Ballasts shall provide rapid starting sequence consistent with ANSI standard C82.11-1993 for rapid start applications.

Ballasts shall provide programmed rapid starting sequence consistent with ANSI standard C82.11 for programmed rapid start applications.

Ballasts shall be Underwriters Laboratory (UL 935) listed, Class P, Type 1 Outdoor, and CSA certified where applicable.

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Ballast shall be physically interchangeable with standard core & coil magnetic ballast when applicable.

Ballasts for T5HO shall have a maximum height of 1.00". Ballasts for T5 and T5HO shall be provided with poke-in wire trap connectors.

Ballasts for T5 and T5HO shall have an end-of-lamp-life detection and shutdown circuit with an auto restart feature to eliminate the need to reset power after lamp replacement.

Ballast shall have a metal enclosure for optimum thermal performance.

Continuous dimming ballasts must be operated with compatible controls.

Ballasts shall carry a five-year warranty when operated at a maximum of 75°C case temperature.

Ballasts shall carry a three-year warranty when operated at a maximum of 85°C case temperature.

All HID ballasts shall be UL component recognized and CSA certified.

END OF SECTION 266000

SECTION 267100 - FIRE ALARM SYSTEM - ADDRESSABLE

1. PART 1 - GENERAL

1.1. RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

The complete installation is to conform to the applicable sections of NFPA 72 and the National Electrical Code with particular attention to Article 760.

The entire installed system and all integrated system operations shall be within guidelines of the UBC, NFPA 90A, NFPA 101, ADA, ASME/ANSI A17. 1 and A17. 3

1.2. SUMMARY

This Section includes fire alarm systems, including manual stations, detectors, notification appliances, signal equipment, controls, and devices.

Work covered by this specification section includes the furnishing of labor, equipment, materials, and complete operational performance required for installation of the Fire Alarm System as shown on the drawings, as specified, and as directed by the Architect/Engineer.

The work covered by this section of the specification is to be coordinated with the related work as specified elsewhere under the project specifications.

1.3. SYSTEM DESCRIPTION

General: Complete, addressable, microprocessor-based fire detection and alarm system with manual and automatic alarm initiation, addressable analog initiating devices.

The fire alarm system shall allow for loading and editing special instructions and operating sequences as required. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software programmed operations shall be stored in a non-volatile memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory.

Network systems shall have the capability of loading software operations from a single node to all other nodes on the network.

The system shall have the capability of recalling alarms and trouble conditions in chronological order for the purpose of recreating an event history.

Loss of primary power at the FACU shall sound a trouble signal at the FACU and shall indicate at the FACU when the system is operating on an alternate power supply.

Annunciation: Manual and automatic operation of alarm and supervisory initiating devices shall be annunciated both on the FACU and on the annunciator, indicating the location and type of device.

FACU Alphanumeric Display: Shall display plain-language description of alarms, trouble signals, supervisory signals, monitoring actions, system and component status, and system commands.

General Alarm: A system general alarm shall include:

Indicating the general alarm condition at the FACU [and the annunciator].

Identifying the device that is the source of the alarm at the FACU and the annunciator.

Displaying the alarm on an 80 character LCD display. The system alarm LED shall flash on the control unit and the graphic annunciator until the alarm has been acknowledged. Once

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acknowledged, this same LED shall latch on. A subsequent alarm received from another zone shall flash the system alarm LED on the control unit and graphic annunciator. The display shall show the new alarm information.

A pulsing alarm tone shall occur within the control unit and the graphic annunciator until the event has been acknowledged.

Operating audible and visible alarm notification signals throughout the building.

Sounding a continuous fire alarm signal until silenced by the alarm silence switch at the control unit or at the graphic annunciator.

All visible alarm notification appliances shall flash continuously until the [Alarm Silence][System Reset] Switch is operated.

Any subsequent zone alarm shall reactivate the alarm notification appliances.

Closing fire and smoke doors normally held open by magnetic door holders. [All doors normally held open by 24 VDC door control devices shall release after a [15] second time delay.]

Unlocking designated doors. Stopping supply and return fans serving zone where alarm is initiated. Closing smoke dampers on system serving zone where alarm is initiated. Initiating smoke control sequence through a signal to the building automatic temperature control system.

Activating any and all FACUs programmed for control of dedicated supply and exhaust fans in an alarm situation. Provide dedicated override control points located near the fan control centers. If the building HVAC controls are used for smoke exhaust, the designated fire alarm control unit shall be programmed to override the HVAC controls and put all fan and dampers into the appropriate fire mode.

Activating the air handling systems per life safety code, NFPA 90A and NFPA 101.

Activating a supervised signal to notify the local fire department.
Initiating automatic elevator recall per ASME/ANSI A17. 1 and A17. 3.

Alarm Silencing

If the "Alarm Silence" button is pressed, all audible alarm signals shall cease operation.

Signals shall not be silenced during the [60] second alarm silence inhibit mode.

1.4. SYSTEM RESET

The "System Reset" button shall be used to return the system to its normal state after an alarm condition has been remedied. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur, should all alarm conditions be cleared.

Should an alarm condition continue, the system will remain in an alarmed state. System control relays shall not reset. The control unit alarm LED shall remain on. The alarmed points will not require acknowledgment if they were previously acknowledged.

Upon reset of the fire alarm control unit, air handling units shall sequentially start up to minimize power demand.

The ability to activate a manual evacuation shall be provided for the purpose of performing evacuation drills.

The ability to perform a manual bypass of selected automatic functions shall be provided.

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The actuation of the "enable one person test" program at the control unit shall activate the "One Person Testing" mode of the system which shall cause the following to occur:

The city circuit connection shall be bypassed.

Control relay functions shall be bypassed.

The control unit shall show a trouble condition.

The alarm activation of any initiation device shall cause the audible notification appliances to code a number of pulses to match the zone or device number.

The unit shall automatically reset itself after signaling is complete.

Any momentary opening of an initiating or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating the trouble condition.

Auxiliary manual controls shall be supervised so that an "off normal" position of any switch shall cause an "off normal" system trouble. The "off normal" status shall be clearly identified in plain-language on the FACU alphanumeric display.

Each independently supervised circuit shall include a discrete readout to indicate disarrangement conditions per circuit.

The System Modules shall be electrically supervised for module placement. Should a module become disconnected the system trouble indicator shall illuminate and the audible trouble signal shall sound.

The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.

1.5. POWER REQUIREMENTS

The control unit shall receive 120 VAC power via a dedicated fused disconnect circuit.

The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of [24] hours with [5] minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.

All circuits requiring system operating power shall be 24 VDC and shall be individually fused or equivalently protected at the control unit.

The incoming power to the system shall be supervised so that any power failure must be audibly and visibly indicated at the control unit and the graphic annunciator. A green "power on" LED shall be displayed continuously while incoming power is present.

The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visibly indicated at the control unit and the graphic annunciator.

If a "LOW BATTERY" condition is left unattended a second stage "DEPLETED BATTERY" trouble condition shall be audibly and visibly reported at the control unit indicating the batteries are below the listed system operating voltage. Systems that completely shut down and fail to indicate a "DEPLETED BATTERY" condition shall be unacceptable.

1.6. SUBMITTALS

General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

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Product data for system components. Include dimensioned plans and elevations showing minimum clearances and installed features and devices. Include list of materials and NRTL-listing data.

Wiring diagrams from manufacturer differentiating between factory- and field-installed wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Indicate components for both field and factory wiring.

Shop drawings showing details of graphic annunciator.

System operation description covering this specific Project including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.

Operating instructions for mounting at the FACU.

Operation and maintenance data for inclusion in Operating and Maintenance Manual specified in Division 1. Include data for each type product, including all features and operating sequences, both automatic and manual. Include recommendations for spare parts to be stocked at the site. Provide the names, addresses, and telephone numbers of service organizations that carry stock of repair parts for the system to be furnished.

Product certification signed by the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.

Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction. Include copies of annotated Contract Drawings as required to depict component locations to facilitate review. Upon receipt of comments from the Authority, submit them for review. Make resubmissions if required to make clarifications or revisions to obtain approval.

Record of field tests of system.

1.7. QUALITY ASSURANCE

Installer Qualifications: A factory-authorized Installer is to perform the Work of this Section.

Compliance With Local Requirements: Comply with the applicable building code, local ordinances, and regulations, and the requirements of the authority having jurisdiction.

Comply with NFPA 70, "National Electrical Code."

NFPA Compliance: Provide fire alarm and detection systems conforming to the requirements of the following publications:

NFPA 72, "National Fire Alarm Code"

NRTL Listing: Provide systems and equipment that are listed and labeled.

Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.

Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory"(NRTL) as defined in OSHA Regulation 1910. 7.

Each and all items of the Fire Alarm System shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriters Laboratories, Inc. (UL), and shall bear the "U. L. " label. All control equipment shall be listed under UL category UOJZ as a single control unit. Partial listings shall NOT be acceptable.

All control equipment must have transient protection to comply with UL864 requirements.

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Where Fire Alarm circuits leave the building, additional transient protection must be provided for each circuit. Devices must be UL listed under standard #497B (Isolated Loop Circuit Protectors).

Architectural and Transportation Barrier Compliance Board: Title III of the Americans with Disabilities Act.

Single-Source Responsibility: Obtain fire alarm components from a single source ISO 9000 certified manufacturer who assumes responsibility for compatibility for system components.

1.8. EXTRA MATERIALS

General: Furnish extra materials, matching products installed (as described below), packaging with protective covering for storage, and identifying with labels clearly describing contents.

Glass Rods for Manual Stations: Furnish quantity equal to 15 percent of the number of manual stations installed; minimum of 6 rods.

Lamps for Strobe Units: Furnish quantity equal to 10 percent of the number of units installed, but not less than one.

Smoke Detectors, Fire Detectors, and Flame Detectors: Furnish quantity equal to 10 percent of the number of units of each type installed but not less than one of each type.

Detector Bases: Furnish quantity equal to 2 percent of the number of units of each type installed but not less than one of each type.

2. PART 2 – PRODUCTS

2.1. MANUFACTURERS

Subject to compliance with requirements, provide alternate products by one of the following:

Simplex Grinnell, Siemens Pyrotronics, Notifier when provided by a certified systems network integrator

Being listed as an acceptable Manufacturer in no way relieves the Contractors obligation to provide all equipment and features in accordance with these specifications.

If equipment of another manufacturer is submitted for approval, the contractor shall state how much is to be deducted from the base bid for the substitution, and also shall state what, if any, specific points of system operation differ from the specified points of the system operation. This differentiation report must reference every paragraph of this specification.

The Manufacturer shall be a nationally recognized company specializing in [smoke detection and] fire alarm systems. This organization shall employ factory trained [and] [NICET] [certified] technicians, and shall maintain a service organization within [100] miles of this project location. The Manufacturer and service organization shall have a minimum of [10] years experience in the fire protective signaling systems industry.

DELETE PRODUCTS BELOW NOT APPLICABLE TO THE PROJECT.

2.2. MANUAL PULL STATIONS

Description: [Single][Double]-action type, fabricated of high impact red polycarbonate or metal, and finished in red with molded, raised-letter operating instructions of contrasting color. [The manual station shall be fitted with screw terminals for field wire attachment.] Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the FACU.

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Stations requiring the breaking of a glass panel are not acceptable. Stations requiring the breaking of a concealed rod may be provided.

Station Reset: The front of the station is to be hinged to a backplate assembly and must be opened with a key to reset the station. The key shall be common with the FACU. Stations which use Allen wrenches or special tools to reset will not be accepted.

Addressable pull stations will contain a communication transmitter and receiver having a unique identification and capability for status reporting to the FACU. There shall be no limit to the number of stations, sensors, or zone adapter modules, which may be activated or "in alarm" simultaneously.

The addressable manual station shall be Underwriters' Laboratories, Inc. listed.

Protective Shield: Provide a tamperproof, clear polycarbonate shield and red frame that easily fits over manual pull stations. When shield is lifted to gain access to the station, a battery powered piercing warning horn shall be activated. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85 dB at 10 feet and shall be powered by a 9 VDC battery.

2.3. SMOKE SENSORS and BASES

General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems. " Include the following features:

Factory Nameplate: Serial number and type identification.

Operating Voltage: 24 VDC, nominal.

Self-Restoring: Sensors do not require resetting or readjustment after actuation to restore them to normal operation.

Modular Arrangement: Sensor and associated encapsulated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. The plug connection requires no springs for secure mounting and contact maintenance. Terminals in the fixed base accept building wiring. Sensor construction shall have a mounting base with a twist-lock detecting head that is lockable. The locking feature must be field removable when not required. Removal of the sensor head shall cause a trouble signal at the FACU. Sensor design shall provide compatibility with other fire alarm detection loop devices (heat sensors, pull stations, etc.)

Quick Connect Arrangement: Photoelectric Sensor and electronics in a single piece construction with a pluggable pressure fit terminal block connection. The single piece unit shall twist-lock onto a supplied mounting bracket which attaches to a standard electrical box. Removal of the quick connect terminal block shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the FACU. Sensitivity range from 2.5% to 3.7% smoke obscuration programmable for standard application requirements

Each sensor shall contain an LED that will flash each time it is scanned by the FACU. When the FACU determines that a sensor is in an alarm or a trouble condition, the FACU shall command the LED on that sensor's base to activate steadily indicating the abnormal condition. Sensors without this visible indication shall not be acceptable. Sensor LEDs that are on due to a trouble condition shall be deactivated when an alarm is active in the system.

Each sensor shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.

Each sensor shall be scanned by the FACU for its type identification to prevent inadvertent substitution of another sensor type. The FACU shall provide default alarm operation with the installed device but shall initiate a "Wrong Device" trouble condition until the proper type is installed

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or the programmed sensor type is changed. Smoke sensors shall be capable of being replaced with Heat sensors to provide protection during construction and renovation without reprogramming.

The sensor's electronics shall be immune from false alarms caused by EMI and RFI.

Visual Indicator: Connected to indicate sensor has operated.

Addressability: Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACU.

DELETE PRODUCTS BELOW NOT APPLICABLE TO THE PROJECT.

Modular Photoelectric Smoke Sensors: Include the following features and characteristics:

An infrared sensor light with matching photosensitive receiver actuated by the presence of visible products of combustion.

The photo sensor sensitivity range shall be programmable from 0.2% to 3.7% smoke obscuration for applications from clean rooms to mechanical equipment rooms.

Modular Ionization Type Smoke Sensors: Include the following features and characteristics:

Multiple chamber type operating on the ionization principle and actuated by the presence of invisible products of combustion.

The ionization sensor sensitivity range shall be programmable from 0.5% to 1.7% smoke obscuration.

Modular Bases: Each modular base shall accept either a photoelectric, ionization, or heat sensor. Means shall be provided for address setting and for connection of communications wiring.

Standard modular base: A standard base shall be available without provisions for additional functions.

Remote LED Base: Shall include provisions for connection of a remote LED alarm indicator.

Relay Base: Shall include provisions for connection of a remote relay and remote LED alarm indicator with the following characteristics:

The remote relay shall be capable of being activated by the FACU independent of the status of the base's sensor, and requiring only one control panel address.

The relay base shall supervise connections to the remote relay allowing it to be mounted remotely from the sensor base location.

In addition to the remote relay, the relay base shall have provisions for the connection of a remote LED alarm indicator.

Isolator Base: Shall have provisions for isolating the communications wiring to the device level per the following:

In the event of a short circuit or a fault to earth, the isolator base shall be capable of isolating both lines of the input and output communications from each other such that the fault is isolated from the rest of the communications wiring.

Normal operating mode of the fault isolation operation shall be automatic such that base status is communicated to the FACU when a fault occurs.

For purposes of system analysis, the isolation operation shall be capable of being manually initiated at the FACU. This process shall be clearly identified at the FACU to expedite the location of communications wiring earth faults.

Power for operation of the isolator base shall be provided by the communications wiring.

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Duct Smoke Sensor: Photoelectric type, [with sampling tube of design and dimensions] as recommended by the manufacturer for the specific duct size and installation conditions where applied. [Duct Sensor includes relay as required for fan shutdown.]

The addressable duct smoke sensors shall operate on the light scattering, photodiode principle, and shall automatically communicate actual smoke chamber values to the system FACU. The sensors shall not have a self contained smoke sensitivity setting. The sensor's electronics shall be shielded to protect against nuisance alarms from EMI and RFI.

The Duct Housing shall provide an auxiliary alarm relay with a single "Form C" contact rated at 1 A @ 28 VDC resistive. This auxiliary relay operates when the sensor reaches its alarm threshold, or when the FACU via software control, manually or automatically operates the relay in response to inputs from other devices.

For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.

Each duct sensor shall have a Remote Test Station with an alarm LED and test switch.

The duct sensor sensitivity range shall be programmable from 0.5% to 3.7% smoke obscuration.

2.4. OTHER SENSORS and DETECTORS

Modular Thermal Sensor: Rate-compensated/fixed-temperature type with plug-in base and alarm indication LED. Sensors have a communication transmitter and receiver with unique identification and capability for status reporting to the FACU. Thermal Sensors shall have a programmable sensitivity of 135° F or 155° F Fixed Temperature, and 15° F or 20° F Rate of Rise. The Rate of Rise operation shall be capable of being disabled.

Flame Detector: Ultraviolet/Infrared type with solid state amplifier switching circuit set for 3 second delay unless otherwise indicated.

2.5. ALARM NOTIFICATION APPLIANCES

REVISE dB LEVELS TO SUIT PROJECT.

General: Equip alarm notification appliances for mounting as indicated. Provide terminal blocks for system connections.

Fire Alarm Horns: Electric vibrating polarized type, operating on 24 VDC, with provision for housing the operating mechanism behind a grille. [Electronic polarized type operating with a piezoelectric element driven with a multiple harmonic signal.] Horns produce a sound pressure level of [87] [85]dB, measured 10 feet from the source.

Fire Alarm Bells: Electric vibrating, 24 VDC, under-dome type, with provision for housing the operating mechanism behind the bell. When operating, bells provide a sound pressure level of [84] dB, measured 10 feet from the bell. 10 inch size except as indicated. Bells are weatherproof where indicated.

Visual Notification Appliances: [110] [30] [15] candela xenon flash output, 24 VDC operation, wall mounted, compatible with ADA requirements with the word "FIRE" clearly visible.

Combination notification appliances consist of factory combined, audible and visual notification units in a single mounting assembly.

DELETE PRODUCTS BELOW NOT APPLICABLE TO THE PROJECT.

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2.6. ADDRESSABLE CIRCUIT INTERFACE MODULES

Addressable Circuit Interface Modules: Arrange to monitor one or more system components that are not otherwise equipped for multiplexing communication. Modules transmit identification and status to the FACU using a communication transmitter and receiver with unique identification and capability for status reporting to the FACU. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable detectors, and for control of notification appliances and AHU systems.

Addressable Circuit Interface Modules shall be capable of mounting in a standard electric outlet box. Modules will receive their operating power from the signaling line or a separate two wire pair running from an appropriate power supply as required.

There shall be three types of modules:

Type 1: Monitor Circuit Interface Module:

For conventional 2-wire smoke detector and/or contact device monitoring with Class B or Class A wiring supervision: This type of module will provide power to and monitor the status of a zone consisting of conventional 2-wire smoke detectors and/or N/O contact devices as specified elsewhere and identified in a schedule on the plans. This module shall communicate four zone status conditions (normal, short, current limited, and open) to the FACU.

For conventional 4-wire smoke detector with Class B wiring supervision: This type of module will provide power to and monitor the contact status of a zone consisting of conventional 4-wire smoke detectors as specified elsewhere and identified in a schedule on the plans. The module will provide detector reset capability and over-current power protection for the 4-wire detector. This module shall communicate four zone status conditions (normal, short, current limited, and open) to the FACU.

Type 2: Line Powered Monitor Circuit Interface Module: This type of module is an individually addressable module that has both its power and its communications supplied by the two wire multiplexing signaling line circuit. It provides location specific addressability to an initiating device by monitoring normally open dry contacts. This module shall communicate four zone status conditions (normal, short, current limited, and open) to the FACU.

Type 3: Line Powered Control Module: This type of module will provide non-supervised form C relay switching with a single "Form C" contact rated at 2 A @ 24 VDC, power limited and at 1/2 A @ 120 VAC, non-power limited. Both power and communications to this module shall be supplied by the two wire multiplexing signaling line circuit. The system shall be capable of energizing 100% of the relays connected to the signaling line circuit.

The Circuit Interface Module shall be supervised and uniquely identified by the FACU. Module identification shall be transmitted to the FACU for processing according to the program instructions. Should the module become non-operational, tampered with, or removed, a discrete trouble signal, unique to the module, shall be transmitted to, and annunciated at, the FACU.

The Circuit Interface Module shall be capable of being programmed for its "address" location on the multiplexing signaling line circuit. The Circuit Interface Module shall be compatible with addressable manual stations and addressable sensors on the same multiplexing signaling line circuit.

2.7. DEVICE LOCATION INDICATING LIGHTS

Description: A system voltage indicating light denotes the location of each sprinkler water flow switch and valve tamper switch. A red laminated, phenolic resin identification plate at the indicating

light bears, in engraved white letters, the room numbers of protected spaces downstream from the waterflow switch, or the room number where the valve is located.

2.8. FIRE ALARM CONTROL UNIT (FACU)

IN THE FOLLOWING PARAGRAPHS, DELETE ITEMS WHICH DO NOT APPLY TO THIS PROJECT.

IN REMODELING AND ALTERATION PROJECTS WHERE THE FACU IS EXISTING AND THE PROJECT REQUIRES ADDITIONS TO THE EXISTING FIRE ALARM SYSTEM, DELETE THE REQUIREMENT FOR A FACU AND SPECIFY ADDITION OF MODULES OR MODIFICATION OF EXISTING FACU.

General: Comply with UL 864, "Control Units for Fire-Protective Signaling Systems. "

Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete FACU, provide exactly matching modular unit enclosures. Accommodate all components and allow ample gutter space for interconnection of units as well as field wiring. Identify each enclosure by an engraved, red laminated, phenolic resin nameplate. Lettering on the enclosure nameplate shall not be less than 1 inch] high

Systems: All modules shall be installed on a single piece chassis to facilitate easy installation and removal. All circuit connections shall be up front and easily accessible.

Control Modules: Types and capacities required to perform all functions of the fire alarm systems [plus 20% for future expansion]. Local, visible, and audible signals notify of alarm, supervisory, and trouble conditions

Zones: Provide for all alarm and supervisory zones indicated.

Alphanumeric Display and System Controls: Arranged to provide the basic interface between human operator at FACU and addressable system components, including annunciation, supervision, and control. A display with a minimum of 80 characters displays alarm, supervisory, and component status messages and indicates control commands to be entered into the system for control of smoke sensor sensitivity and other parameters. Arrange keypad for use in entering and executing control commands.

SPECIFY PRINTED INSTRUCTIONS AS DESCRIBED BELOW IN ALL PROJECTS IN WHICH A NEW FACU IS PROVIDED OR IN WHICH THE FUNCTIONS OF AN EXISTING FACU ARE MODIFIED. WHERE

CHANGES TO THE FACU DO NOT MODIFY ITS FUNCTIONS, DELETE THE PARAGRAPH.

Instructions: Printed or typewritten instruction card mounted behind a polycarbonate plastic or glass cover in a painted steel or aluminum frame. Install the frame in a location observable from the FACU. Include interpretation and appropriate response for displays and signals, and briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

FIRE ALARM CONTROL UNIT (FACU) DEFINED AS NETWORK NODES

FACU construction shall be modular with solid state, microprocessor based electronics. It shall display only those primary controls and displays essential to operation during a fire alarm condition. Keyboards or keypads shall not be required to operate the system during fire alarm conditions. A local audible device shall sound during Alarm, Trouble or Supervisory conditions.

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This audible device shall also sound during each keypress to provide an audible feedback to ensure that the key has been pressed properly.

DELETE CONTROL UNIT HARDWARE BELOW NOT APPLICABLE TO THE PROJECT.

The following FACU hardware shall be provided;

1 base panel with [beige] [red] cabinet and door, [120 VAC] [240 VAC] input power.

250 Addressable point capacity

Addressable Annunciator Circuit

4 Notification Appliance Circuits [Class B] [Class A]

2 Auxiliary Control Relays

Sufficient power to operate the control panel and [4] [8] Amps of Notification Appliances

Battery volt meter and ammeter

[1] [2] Municipal City Circuit(s)

[2 RS-232C Ports] or [1 RS-232C Port and 1 Modem Port]

[Network Communications Card] or [Common Event DACT] or [Point Reporting DACT]

The following primary controls shall be visible through a front access Unit:

Individual red fire alarm LED

Individual yellow supervisory service LED

Eighty character liquid crystal display

Individual yellow trouble LED

Green "power on" LED

Yellow signals silenced LED

Fire alarm acknowledge key

Supervisory service acknowledge key

Trouble acknowledge key

Alarm silence key

System reset key

3 Status indicators for [Waterflow] [Sprinkler Supervisory] [Ground Fault] [future use]

The FACU shall provide the following bypass controls:

Manual Evacuation

City Circuit Bypass

Control Point Bypass

Elevator Bypass

Door Holder Bypass

Lamp Test

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Earth Fault Latch

Display Time & Date

[2 spares for future use]

The FACU shall provide the following operational features:

Setting of time and date

Front Panel and PC Programming capability

Automatic device level general alarm programming with default label generation

Alarm, trouble, and abnormal condition listing

Enabling and disabling of each monitor point separately with abort warning when circuits are enabled

Activation and deactivation of each control point separately

Changing operator access levels

One Person test enable

Running diagnostic functions including "Device Level" Ground Fault Search

Displaying software revision level

Displaying historical logs

Displaying card status

Point listing

Software Verification (simulate mode)

Ground Fault Latch capability

English language reports with analog sensor current value, peak value, alarm sensitivity, and almost dirty data

For additional maintenance purposes the following lists shall be available from the point lists menu:

IDC point list

Analog sensor point list

NAC point list

Auxiliary relay point list

Utility input point list

Utility output point list

Digital pseudo point list

Analog pseudo point list

System status list

2.9. REMOTE LCD ANNUNCIATOR

Provide [1] Remote LCD Annunciator with the same "look and feel" as the control panel operator interface. The remote LCD Annunciator shall use the same Primary Acknowledge, Silence, and

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Reset Keys, Status LEDs and LCD Display as the FACU.

Under normal conditions the LCD shall display a "System is Normal" message and the current time and date.

Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The Unit audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.

The LCD shall display the following information relative to the abnormal condition of a point in the system:

40 character custom location label

Type of device (e.g., smoke, pull station, waterflow)

Point status (e.g., alarm, trouble)

Operator keys shall be key switch enabled to prevent unauthorized use. The key shall only be removable in the disabled position. Acknowledge, Silence and Reset operation shall be the same as on the FACU.

2.10. EMERGENCY POWER SUPPLY

General: Components include battery, charger, and an automatic transfer switch.

Battery: Sealed lead-acid type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of [24] hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all notification appliances in alarm or supervisory mode for a period of [5] minutes.

DELETE BELOW WHERE PROJECT DOES NOT CONTAIN MAGNETIC DOOR HOLDERS.

Magnetic door holders are not served by emergency battery power. Magnetic door holders are released after [15] seconds when normal power fails.

2.11. WIRE AND CABLES

Line Voltage and Low Voltage Circuits: Solid copper conductors with 600 V rated insulation installed in conduit.

3. PART 3 - EXECUTION

Install system according to NFPA Standards referenced in Parts 1 and 2 of this Section.

Fire Alarm Power Supply Disconnect: Shall be painted red and labeled "FIRE ALARM. " Provide with a lockable handle or cover.

3.1. EQUIPMENT INSTALLATION

Furnish and install a complete Fire Alarm System as described herein and as shown on the plans; to be wired, connected, and left in first class operating condition. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.

DELETE 2 PARAGRAPHS BELOW EXCEPT WHERE PROJECT REQUIRES REPLACEMENT OR EXTENSION OF AN EXISTING SYSTEM IN AN OCCUPIED BUILDING.

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Existing Fire Alarm Equipment: Shall be maintained fully operational until the new equipment has been tested and accepted. As new equipment is installed, it shall be labeled "NOT IN SERVICE" until the new equipment is accepted. Remove tags from new equipment when put into service and tag existing fire alarm equipment "NOT IN SERVICE" until removed from the building.

Equipment Removal: After acceptance of the new fire alarm system, disconnect and remove the existing fire alarm equipment and restore damaged surfaces. Package operational fire alarm and detection equipment that has been removed and deliver to the Owner. Remove from the site and legally dispose of the remainder of the existing material.

Manual Pull Stations: Mount semi-flush in recessed back boxes with operating handles 48 inches above finished floor or as indicated.

Water-Flow Detectors and Valve Supervisory Switches: Connect for each sprinkler valve station required to be supervised.

Smoke Detectors: Install ceiling-mounted detectors not less than 4 inches from a sidewall to the near edge. Install detectors located on the wall at least 4 inches but not more than 12 inches below the ceiling. For exposed solid joist construction, mount detectors on the bottoms of the joists. On smooth ceilings, install detectors not over 30 feet apart in any direction. Install detectors no closer than 5 feet from air registers.

Audible Notification Appliances: Install not less than 80 inches above the finished floor nor less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille or as indicated. Combine audible and visual notification appliances at the same location into a single unit.

Visual Notification Appliances: Install adjacent to each alarm bell or alarm horn and not less than 80 inches above the finished floor and at least 6 inches below the ceiling.

Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.

Fire Alarm Control Unit (FACU): Surface mount with tops of cabinets not more than 6 feet above the finished floor.

Graphic Annunciator: Arrange as indicated, with the top of the Unit no more than 6 feet above the finished floor.

3.2. WIRING INSTALLATION

Wiring Method: Install wiring in metal raceway, conceal raceway except in unfinished spaces and as indicated.

Wiring Within Enclosures: Install conductors parallel with or at right angles to the sides and back of the enclosure. Bundle, lace, and train the conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the wiring diagrams of the system. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

Cable Taps: Use numbered terminal strips in junction, pull or outlet boxes, cabinets, or equipment enclosures where any circuit tap is made.

System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the Authority Having Jurisdiction (AHJ) and shall be installed in accordance with the appropriate articles from the current approved edition of the National Electric Code (NEC)(NFPA 70). It is the Contractor's responsibility to obtain from the Fire Alarm System Manufacturer written

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instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.

Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.

Fan Shutdown: Air handling equipment shall be connected to relays in its' respective duct smoke detector.

3.3. GROUNDING

Ground equipment and conductor and cable shields as specified by the equipment manufacturer. [For audio circuits, minimize to the greatest extent possible ground loops, common mode returns, noise pickup, cross talk, and other impairments.] Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

3.4. FIELD QUALITY CONTROL

Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.

Pretesting: Upon completing installation of the system, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of the witnesses to the preliminary tests.

Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.

Minimum System Tests: Test the system according to the procedures outlined in NFPA 72. Minimum required tests are as follows:

Verify the absence of unwanted voltages between circuit conductors and ground.

Megger test all conductors other than those intentionally and permanently grounded with electronic components disconnected. Test for resistance to ground. Report readings less than 1 megohm for evaluation.

Test all conductors for short circuits utilizing an insulation-testing device.

With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on the record drawings.

Verify the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.

Test initiating, notification, and signaling circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of the initiating and notification devices. Observe proper signal transmission according to class of wiring used.

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Test each initiating device and notification appliance for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.

Measure and record the actual current draw of each Notification Appliance Circuit.

Test the system for all specified functions according to the manufacturer's operating and maintenance manual. Systematically initiate specified functional performance items at each station including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications.

Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the period and in the manner specified.

Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log upon the satisfactory completion of tests.

Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

Final Test, Certificate of Completion, and Certificate of Occupancy:

Test the system as required by the Authority Having Jurisdiction in order to obtain a certificate of occupancy. Demonstrate that the system meets the Specifications and complies with applicable standards. This final test shall be witnessed by a representative of the Authority Having Jurisdiction and a factory-authorized service representative.

3.5. CLEANING AND ADJUSTING

Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.6. TRAINING

Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.

Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of [4] hours' training.

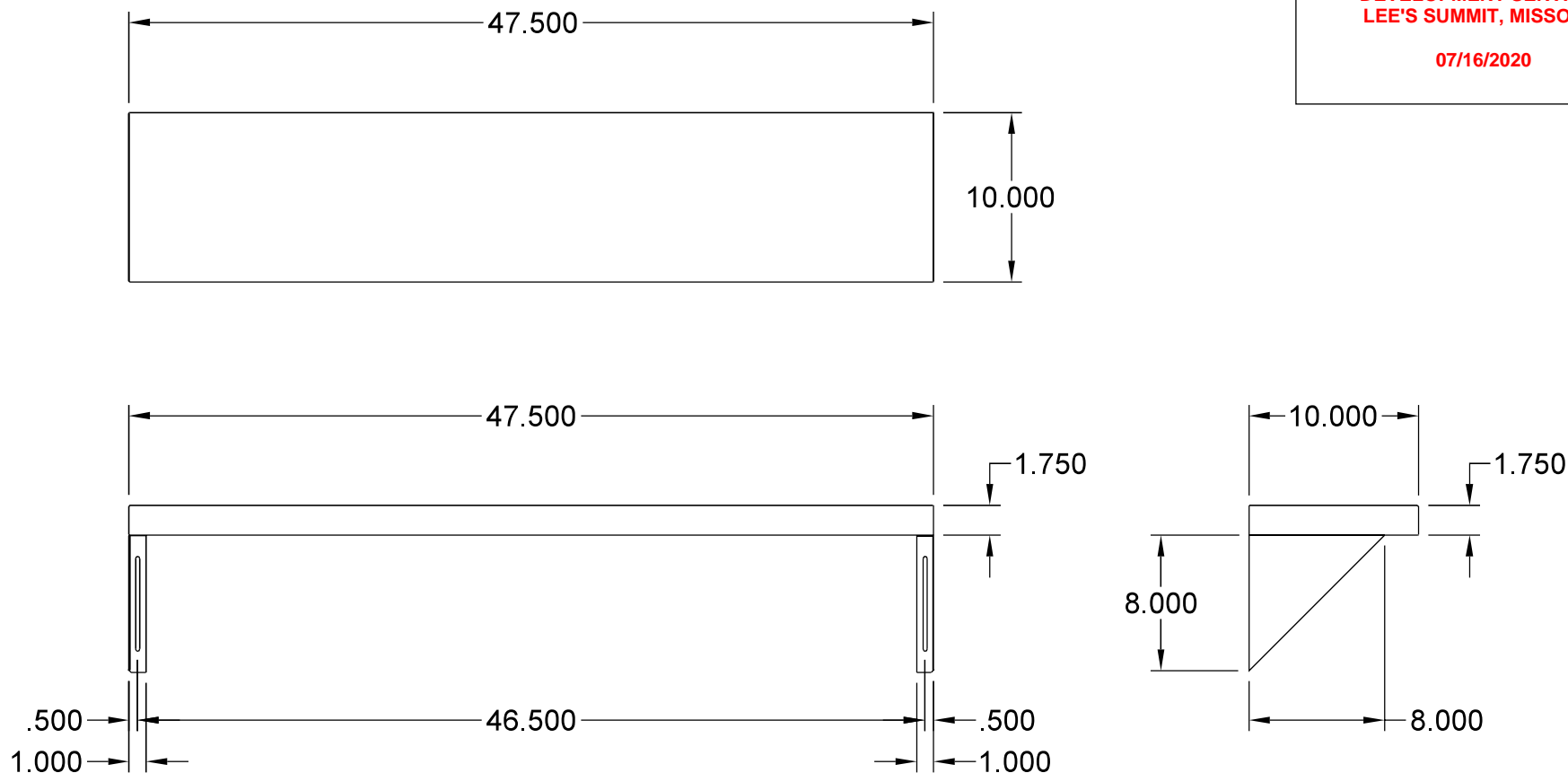
Schedule training with the Owner at least seven days in advance.

END OF SECTION 267100

West Pryor Lot 3

**RELEASE FOR
CONSTRUCTION
AS NOTED ON PLANS REVIEW
DEVELOPMENT SERVICES
LEE'S SUMMIT, MISSOURI
Lee's Summit, MO
07/16/2020**

07/16/2020



MODEL 275 SHELF

<div>WORK TO DIMENSIONS-DO NOT SCALE</div> <div>TOL. UNLESS SPECIFIED</div> <div>XXXX TOL. NOT REQ'D</div> <div>TOL. CLASS ± .030</div> <div>ANGULAR TOL. ± 1°</div>	USED IN PRODUCTS:	DESIGN BY: PFB	MATERIAL:	<div>READY ACCESS®</div> <div>1815 Arthur Drive • West Chicago, Illinois 80185 • 800-621-5045 • 630-876-7766 • Fax 630-876-7767</div>
	275	DATE: 5.19.06	MATERIAL SPEC:	
	REVISION: A	DRAWN BY: PFB		
	REVISION DATE: 5.19.06	DATE: 5.19.06	GAUGE:	
	LATEST REVISION NOTE: REV A=SPEC SHELF			DESCRIPTION: 275 SHELF
	10020			PART. NO.:



1815 S. W. 10th St. / Hialeah, FL 33157

760-630-876-7766, Fax: 760-630-876-7767 : Email: info@readyaccess.com

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CONSTRUCTION
AS NOTED ON PLANS REVIEW
DEVELOPMENT SERVICES
LEE'S SUMMIT, MISSOURI**

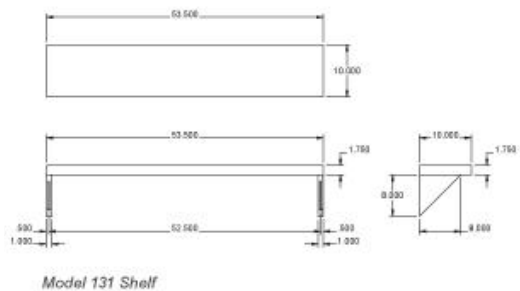
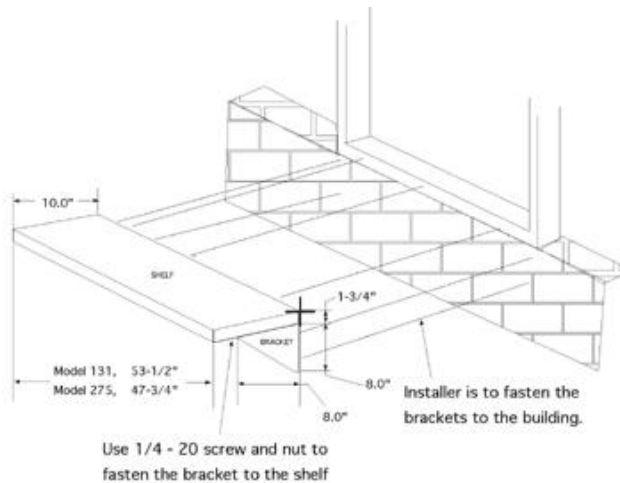
07/16/2020

Each shelf is constructed from 13 gauge stainless steel and is designed to match with your favorite flush mount style window.

Use the screws provided to attach the shelf to the frame of the window. Use the holes in the shelf as a template for making the pilot holes.



131 and 275 Stainless Steel Shelf



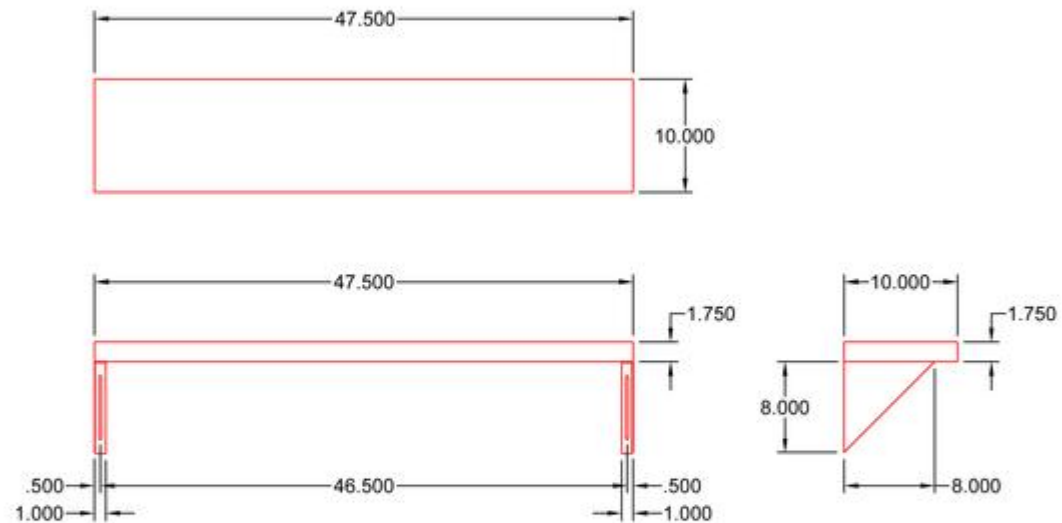
07/16/2020

Stainless Steel Shelves Indoor/Outdoor*



Each shelf is constructed from 13 gauge stainless steel and is designed to match with your favorite flush mount style window.

Use the screws provided to attach the shelf to the frame of the window. Use the holes in the shelf as a template for making the pilot holes.



MODEL 275 SHELF

What the

BEST DRESSED

Drive-thru is Wearing



THE ACCESS AIR 300 PASS-THRU AIR CURTAIN SYSTEM™

For use with the 275 Single Panel Window

The Ready Access AA300 Pass-Thru Air Curtain System is designed to be an integral part of your drive-thru operation by providing comfort for both operator and customer during the coldest of days as well as satisfying health department codes for fly fan application.

- **Modes of Operation**

The Ready Access AA300 Pass-thru Air Curtain System is versatile in function and design, offering operators four separate modes of operation.

- * Outside warm air flow only
- * Inside warm air flow only
- * Both outside and inside warm air flow
- * Outside fly fan operation only

- **Features and Benefits**

Satisfies health department requirements for "Fly Fan" applications while it reduces and deflects the amount of outside wind blowing into the building. This also reduces heating and air-conditioning loss as well as reducing unwanted environment factors such as dust and exhaust fumes from entering the building. Acts as a fly fan to deter insects from entering the building during warm weather conditions.

Provides the owner/operator with a stable, comfortable working environment for all crew members. Reduces Drive-Thru operation expenses by diminishing employee turnover.

- **Unique Design**

The AA300 Air Curtain System is the only system on the market today that offers an outside and inside heated air flow. It is designed for use with any flushmount window.



- **Quality Construction**

The exterior housing of the AA300 Air Curtain System is manufactured using bronze or clear anodized aluminum.

- **Fully Assembled, Ready to Install**

The Access Air 300 system is shipped completely pre-assembled and ready for installation, lowering installation costs. Normal installation for new store construction takes less than two hours.

- **Warranty and Service Support**

Your Access Air 300 System comes with a one year limited warranty on parts and labor. In addition, each Pass-Thru Air Curtain System is backed by a worldwide service organization.

- **AVAILABLE OPTIONS**

Power coat painting is available upon request for a wide range of custom colors.

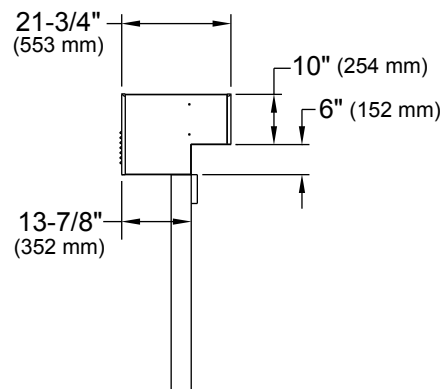
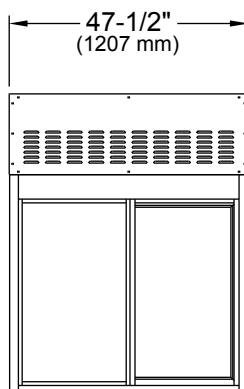
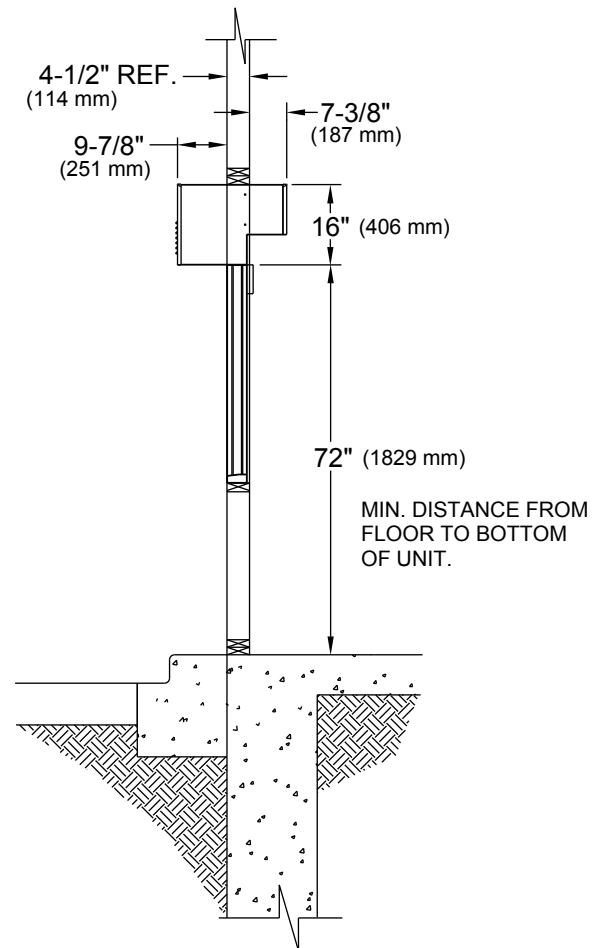
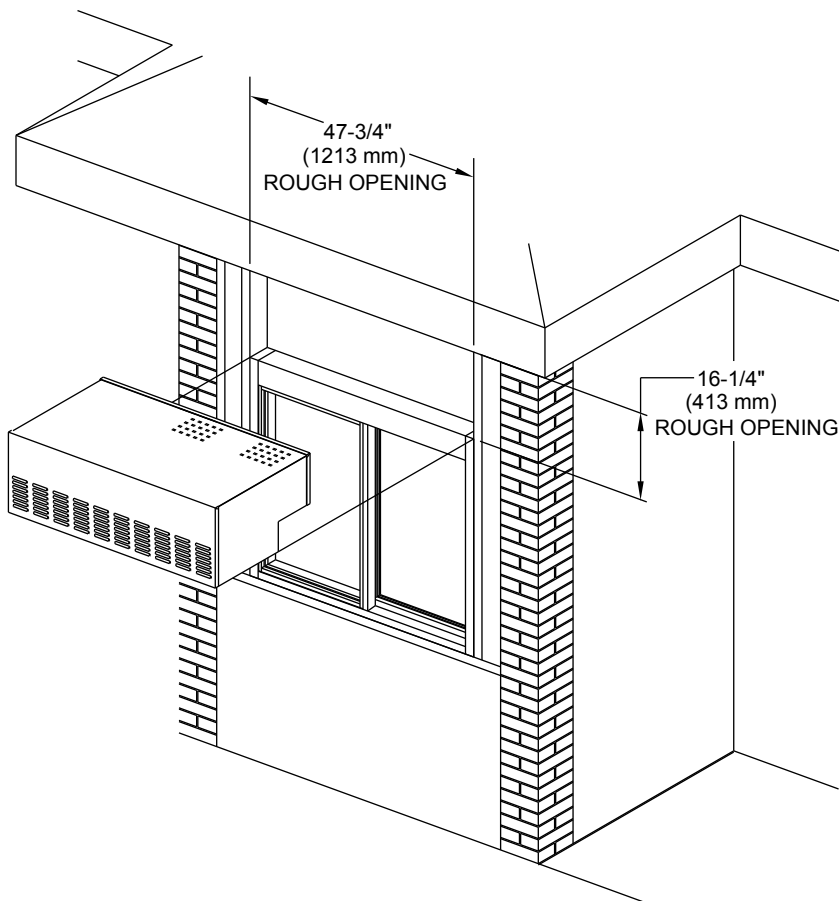
ARRIVES READY FOR INSTALLATION

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Your Ready Access window is shipped completely assembled and ready for installation. Comes with instructions.

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AA300 - 275 PASS-THRU AIR CURTAIN SYSTEM



UNIT SPECIFICATIONS:

- * 208/240 VOLTS
- * 7100 HEATER WATTS
- * 32 ACTUAL UNIT AMPS
- * 1 (SINGLE) PHASE
- * 60 HZ
- * 600 FPM AIR VELOCITY

Window must be installed square and plumb.

Installation illustrations are for reference only. Construction and local codes will determine proper installation of window.

Contact Ready Access for more information on installation.



What the

BEST DRESSED

Drive-thru is Wearing



275 SINGLE PANEL SLIDER SERIES

For retail operators who want to get an edge on their competition by offering customers convenient, face-to-face service, the 275 Single Panel Slider is perfect. Ideal for fast food, walk-up service, and many other applications.

PRODUCT DESCRIPTIONS

- **4 Standard Sizes Available**

- 47 1/2"W x 43 1/2"H with a 19" wide x 36" high service opening
- 47 1/2"W x 35 3/4"H with a 19" wide x 28" high service opening
- 47 1/2"W x 35 3/4"H with a 15" wide x 28" high service opening
- 35 3/4"W x 35 3/4"H with a 14" wide x 28" high service opening (SC / MOER)
- Passes California restricted opening requirements of 432 square inches.

- **3 Modes of Operation**

- **275 Manual Open/Self Closing**

So simple to operate, the service door opens effortlessly and automatically slides shut when operator releases the handle.

- **275 M.O.E.R. (Manual Open/Electronic Release)**

The 275 Manual Open/Electronic Release Window has a manual open, self closing operation which electro-magnetically holds the window open until the operator finishes their transaction and steps out of the presence sensor. This unit is field adjustable to the length of time the window will stay open.

- **275 Electric**

With a hands-free operation the 275 Electric Window is ideal for heavy traffic situations. It provides easier operation and speedier service than the manual operating windows. This unit is field adjustable to the length of time the window will stay open.

- **Quality Construction**

Anodized aluminum extrusions, stainless steel and 1/4" tempered glass combine to give you an attractive window that not only enhances building exteriors, it will not rust, pit or weather. Track free bottom sill provides for a contaminant free surface.

- **Triple Security Locks**

The 275 automatically locks each time the window closes, providing security when the window is left unattended. When the drive-thru is closed, thumbturn & night security bar helps prevent outside entry. In high risk locations, an optional security bar set is available.



- **Fully Assembled, Ready to Install**

Ready Access windows are shipped completely preassembled, and fully glazed for lower installation costs. Normal installation takes less than two hours.

- **Unique Design**

Bottom sill is angled downward to provide protection against the elements such as rain, sleet, and snow.

- **Warranty and Service Support**

Your Ready Access window comes with a one year limited warranty on parts and labor. Each window is backed by a worldwide service organization.

- **STANDARD OPTIONS**

The 275 series window is available in statuary bronze, or clear anodized aluminum.

A retrofit kit is available for the 275 Self Closer that easily upgrades the window from a manual operation to a MOER or fully automatic electric operation.

Right to left or left to right opening available (as seen from outside view).

For non food service applications window can be made manual open / manual close.

- **CUSTOM OPTIONS**

Custom sizes are available to satisfy any unusual operations requirement or health department code.

Tinted glass is available upon request.

Powder coat painting is available in a wide range of custom colors.

14077

ARRIVES READY FOR INSTALLATION

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07/16/2020

Your Ready Access window is shipped completely assembled and ready for installation. Comes with instructions.

275 SERIES



275 - 47-1/2"W x 43-1/2"H

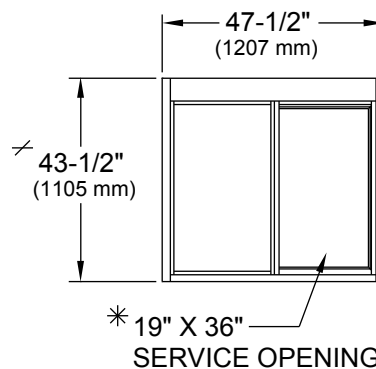
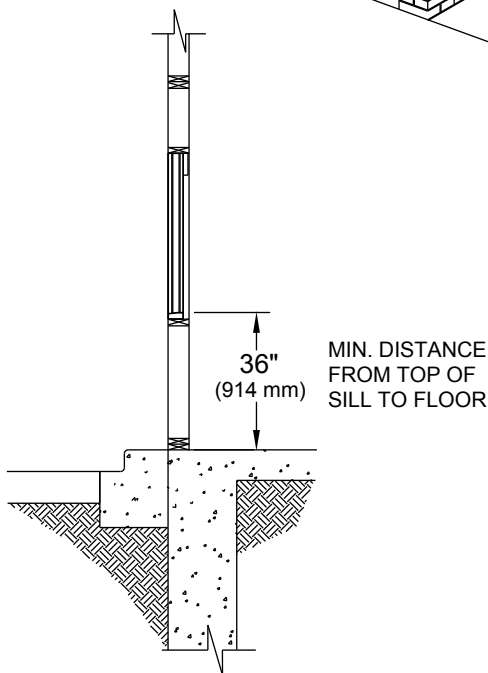
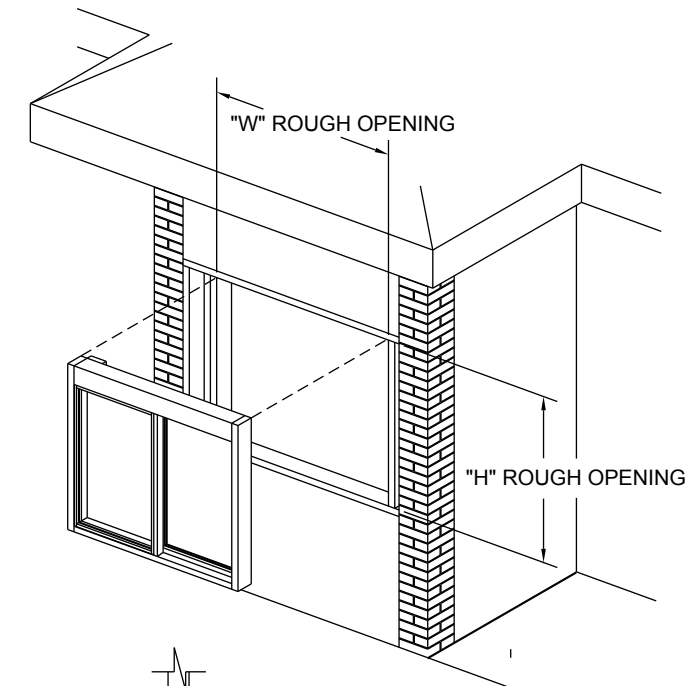
Glazing Rough Opening =
47-3/4"W (1213 mm) x 43-3/4"H (1111 mm)
Masonry Rough Opening =
48"W (1219 mm) x 44"H (1118 mm)

275 - 47-1/2"W x 35-3/4"H

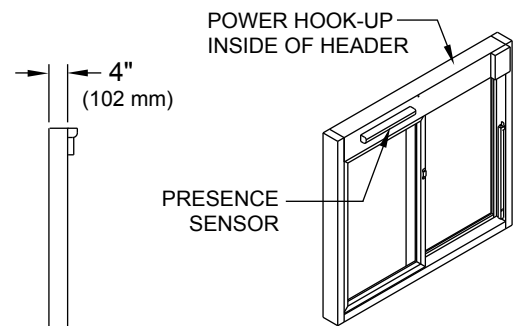
Glazing Rough Opening =
47-3/4"W (1213 mm) x 36"H (914 mm)
Masonry Rough Opening =
48"W (1219 mm) x 36-1/4"H (921 mm)

275 - 35-3/4"W x 35-3/4"H

Glazing Rough Opening =
36"W (914 mm) x 36"H (914 mm)
Masonry Rough Opening =
36-1/4"W (921 mm) x 36-1/4"H (921 mm)



FOR FULLY AUTOMATIC ELECTRIC UNIT



BOTH SIDE FRAMES ARE HOLLOW FOR ELECTRICAL ACCESS FROM EACH CORNER LEADING TO THE HEADER.

ELECTRICAL REQUIREMENTS

USA (DOMESTIC) : 115 vac - 60 Hz WITH A 15 amp BRANCH CIRCUIT
INTERNATIONAL : 220/240 vac - 50/60 Hz WITH A MAX.
8 amp BRANCH CIRCUIT

* TWO STANDARD WINDOW HEIGHTS

43-1/2" H WITH 19"W x 36"H SERVICE

35-3/4" H WITH 19"W x 28"H + 15"W x 28"H SERVICE



14077

Product Application Guideline—Ready Access Drive Thru Window Systems

Rough Opening 48" w x 60" h, Service Opening 19" x 36", Heated Air Curtain Required

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Product Description:

275 Series single panel slider MOER window
and AA300 Heated Air Curtain

BOM:

Window 275 single panel slide window w/attached
M.O.E.R.-Manual Open/Electronic Release operation
47 1/2" w x 59 1/2" h Overall Frame Height
47 1/2" w x 43 1/2" h Window Frame Size, Service Opening 19" w x 36" h
1/4" Tempered Clear Glass
Left to Right Operation from "outside view"
Clear (silver) Anodized finish on aluminum
Heated Air Curtain AA300 47 1/2" w x 16" h
Left to Right Operation, Clear Anodized

Options:

Aluminum finishes:

- ☐ Bronze (dark brown)
- ☐ Painted (up-charge for Tiger Drylac powder coat painted finishes, no custom)

Slide of window:

- ☐ Right to Left from "outside view"

Extreme Cold Weather Climates:

- ☐ 600 series single panel slider in lieu of 275 series, w/ 3/4" Insulated Clear Glass
Aluminum Extrusion size of 600 series 2" x 4 1/2", same Mode of Operation M.O.E.R.

LEED Requirements or Modular Projects:

- ☐ 600 series w/ 3/4" Insulated LOW E PPG 70 XL Glass

****Options must be specified on request for quote****

Electrical Requirements:

Window - USA(domestic) 110/120vac-60Hz (does not require
dedicated circuit) M.O.E.R.-Manual Open/Electronic Release Operation
wiring options:

- 3' cord provided, wire directly into terminal block, plug into outlet provided by electrician, note polarity of insulated wire:

Green	Ground
Ribbed Insulated Black Wire (with seam)	Neutral
Smooth Black Insulated Wire	Hot-Live

- Wire directly from breaker box into terminal block inside header of window, run wiring from fixed side, up thru extrusion to header, leaving approximately a 5' whip

Air Curtain - USA (domestic) 208/240 volts 60Hz-32 amps, 1 phase (dedicated circuit required)

Application Notes:

Use when R.O. is 48" w x 60" high, AA300 heated air curtains required

Architect is responsible for compliance with all local codes. All drawings are for reference only

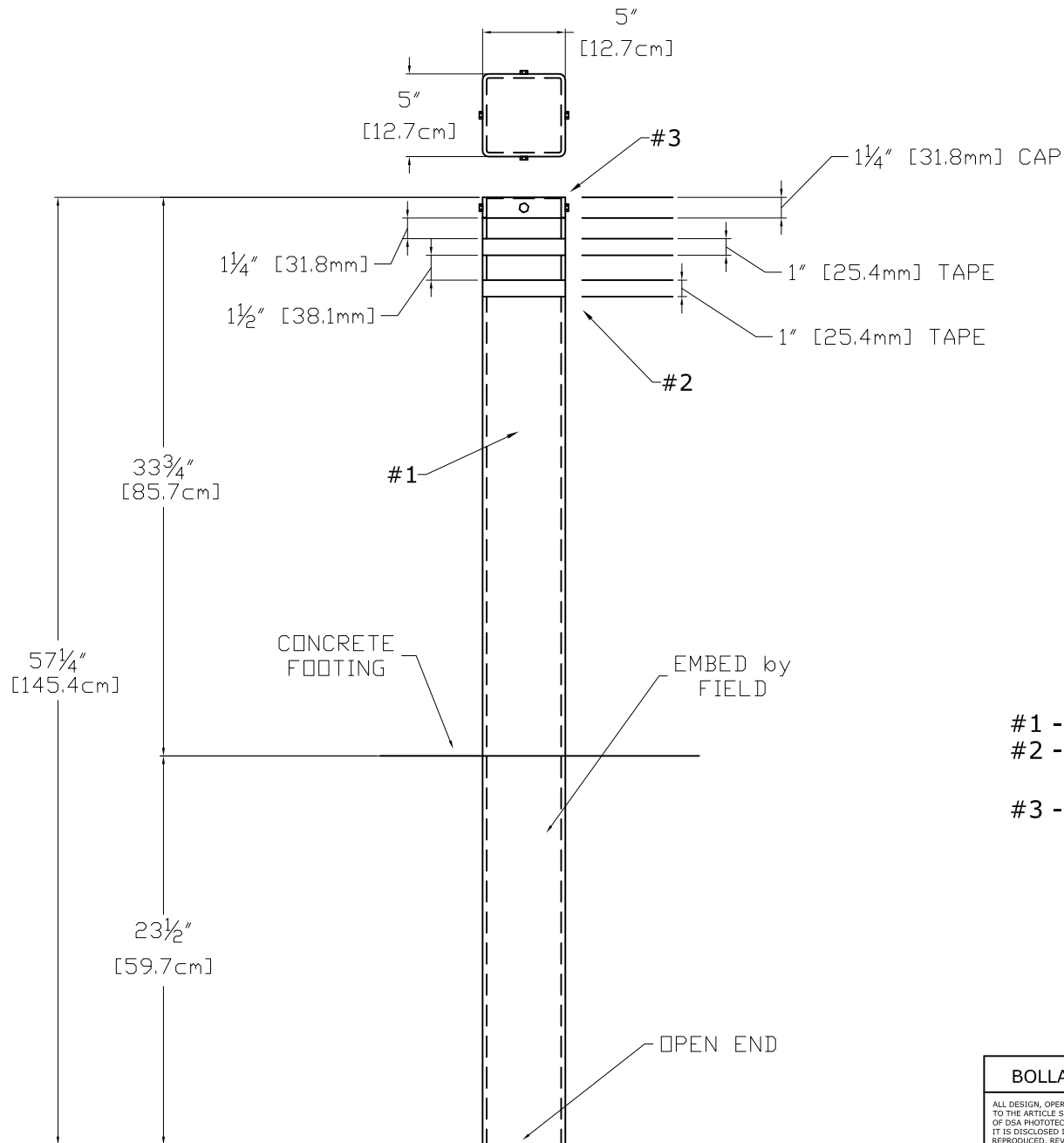
Window and Air Curtains must be square and plumb

To retrieve cut sheets, CAD drawings, specifications, installation/service/operations manuals please visit:

<http://www.ready-access.com/Architect.html>

14077


07/16/2020



- #1 - 5"x5"x1/4" [6mm] SQUARE STEEL POST
- #2 - TWO BANDS OF 1" WIDE ENG. GRADE SILVER/WHITE REFLECTIVE TAPE
- #3 - WELDED STEEL REMOVABLE CAP w/ POWDER-COATED S-S FASTENERS

RAL7021 BLACK GREY, 10% SHEEN, EXT

APPROVED
02/04/14

BOLLARD NON-ILLUMINATED SQUARE			
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	02/13/14		



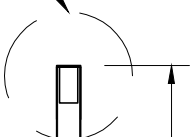
Dolan Hospitality
26 South Hanford St.
Seattle, WA 98134, USA
Toll Free Ph: 888-506-7383
Toll Free Fax: 866-268-1967
info@dolanhospitality.com

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	MFR#:	621038
	DESCRIPTION:	LED String Light-24 Bulbs, 48 feet in lenth
	DIMENSIONS:	48 feet long and hang down 9"
	CERTIFICATION:	
	WET RATED:	YES
	TITLE 24:	NO
	DARK SKY:	NO
	FIXTURE COLOR:	BLACK
	SHADE MATERIAL:	Impact Resistant Clear Acrylic
	CORD:	48'
	FASTENERS USED:	May hang at each bulb location
	WARRANTY:	3 YEARS
	COUNTRY OF ORIGIN:	CHINA
	BOX SIZE:	L9"xW9"x H18"/ L228mm x W228mm x H457mm
	QTY PER CARTON:	1
	QTY PER MASTER PACK:	1
	ITEM WEIGHT(GROSS):	11.8 Lbs
	ITEM WEIGHT(NET):	11 Lbs
	COMMENTS:	
		Plug on end, Linkable up to 350 feet, 6 strings max Bulbs are non removable or replaceable
	BULB:	Integrated LED .96 Watt each, 23 Watt total string
	SOCKET TYPE:	LED Non Removable module
	WATTAGE:	N/A
	MAX WATTAGE STICKER	N/A
	VOLTAGE:	120V
	HERTZ:	N/A
	KELVIN TEMP:	2700 Kelvin
	BULBS INCLUDED:	Yes

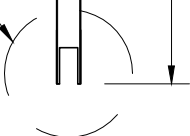
DETAIL A



2" x 2" x .090"
ALUM. TUBE

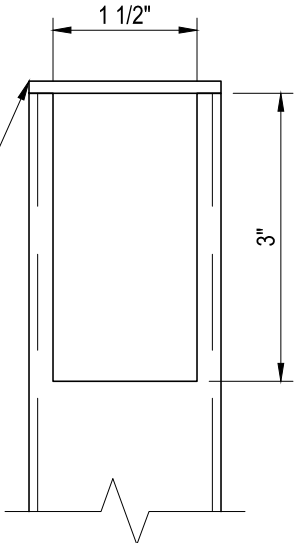
10'
LIGHT POLE HEIGHT

DETAIL B



DID 18818
10' POST
(MODEL# 1072-1)

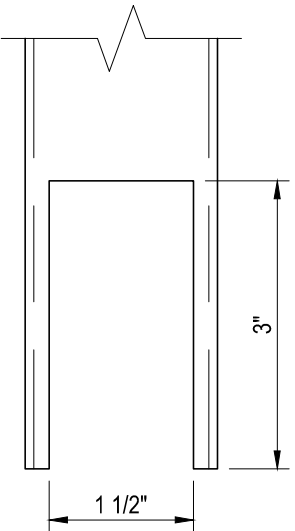
.125" ALUM.
ENDCAP
(WELD
& GRIND
SMOOTH)



SIDE VIEW

OPENING FOR CORD (TOP) DETAIL

DETAIL A
SCALE: 6"=1'-0"



SIDE VIEW

OPENING FOR CORD (BOTTOM) DETAIL

DETAIL B
SCALE: 6"=1'-0"

STARBUCKS - LIGHT POLE (OPTIONS)				STARBUCKS			
10' POST (MODEL# 1072-1)							
PROJECT NAME:	DRAWING NAME:	CUSTOMER:	REV	DATE	BY	DESCRIPTION	
			IR	08/31/15	PDB	INITIAL DESIGN	
			A	10/02/15	HJB	REVISIONS PER MARK UPS	

SHIPPING ADDRESS:

CONTRACTOR:

CONTACT:
PHONE#:
CELL#:

DWN BY:	CHK BY:	ENG. BY:
PDB	—	—

SCALE: 3/4"=1'-0" UNO

SHT. NO:

SHT 2

Ball Ground, Ga. 30107
www.awnexinc.com
Ph. 770-704-7140 Fax 770-704-7647

STARBUCKS - LIGHT POLE (OPTIONS)				STARBUCKS			
12' POLE (MODEL# 1072-2)							
PROJECT NAME:		DRAWING NAME:		CUSTOMER:		DESCRIPTION	
REV	DATE	BY	PDB	HUB	REVISIONS PER MARK UPS	INITIAL DESIGN	
IR	08/31/15						
A	10/02/15						

SHIPPING ADDRESS:

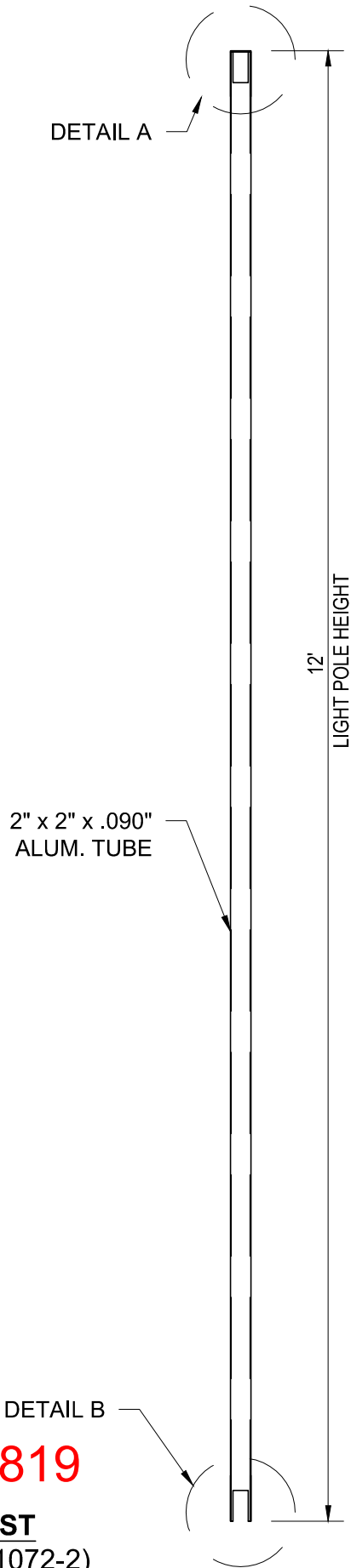
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CONTACT:
PHONE#:
CELL#:

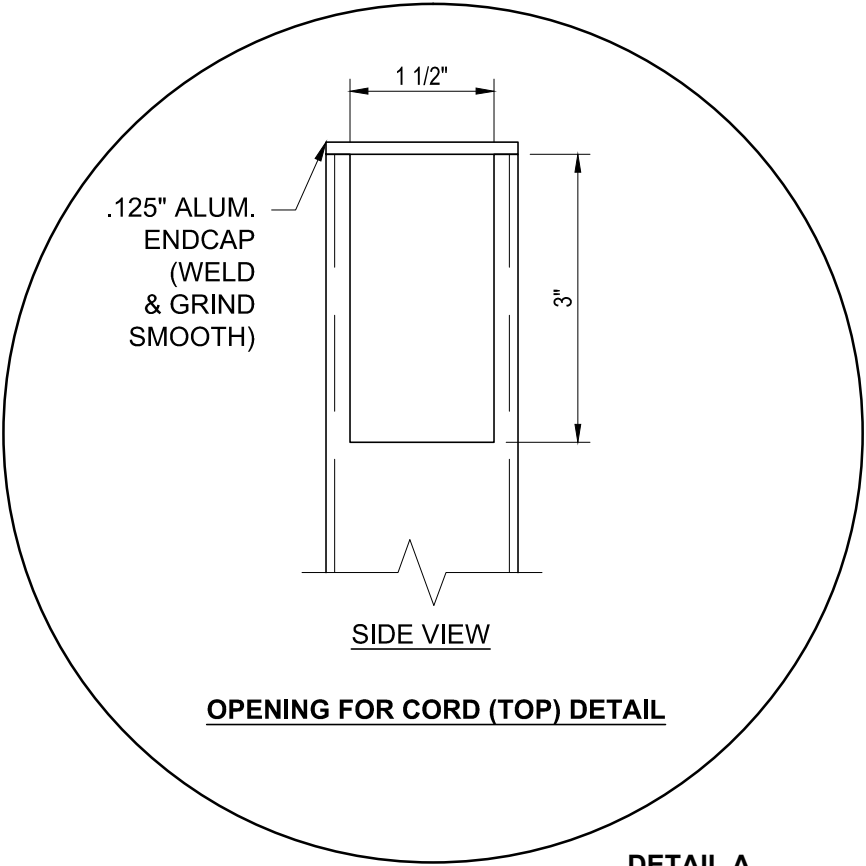
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PDB	—	—

SCALE: 3/4"=1'-0" UNO
SHT. NO: SHT 3

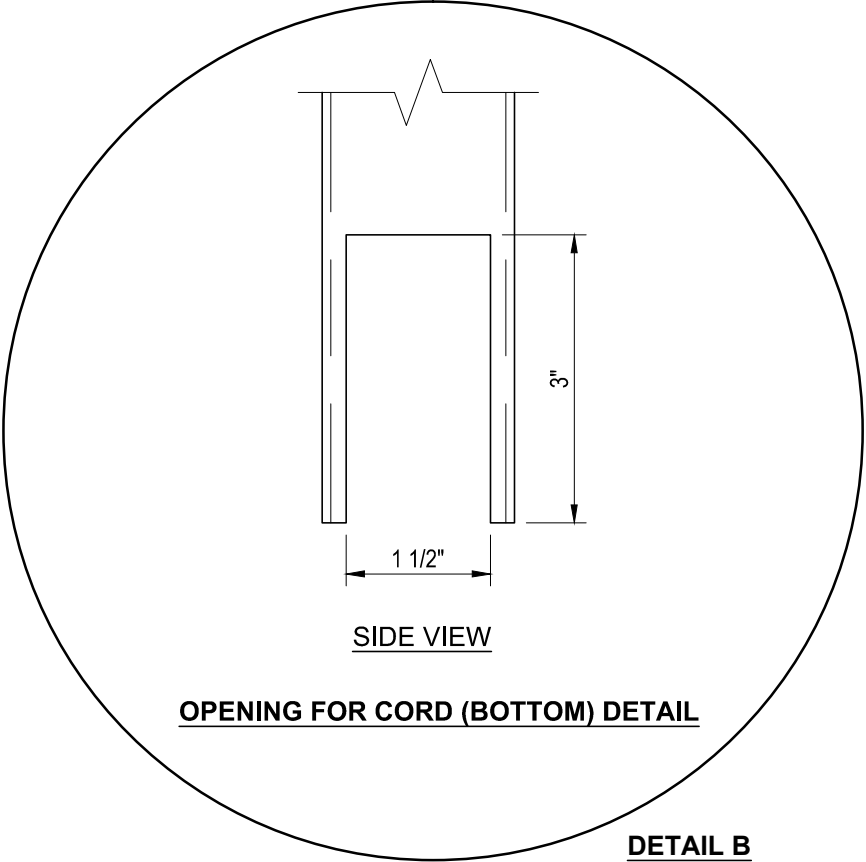
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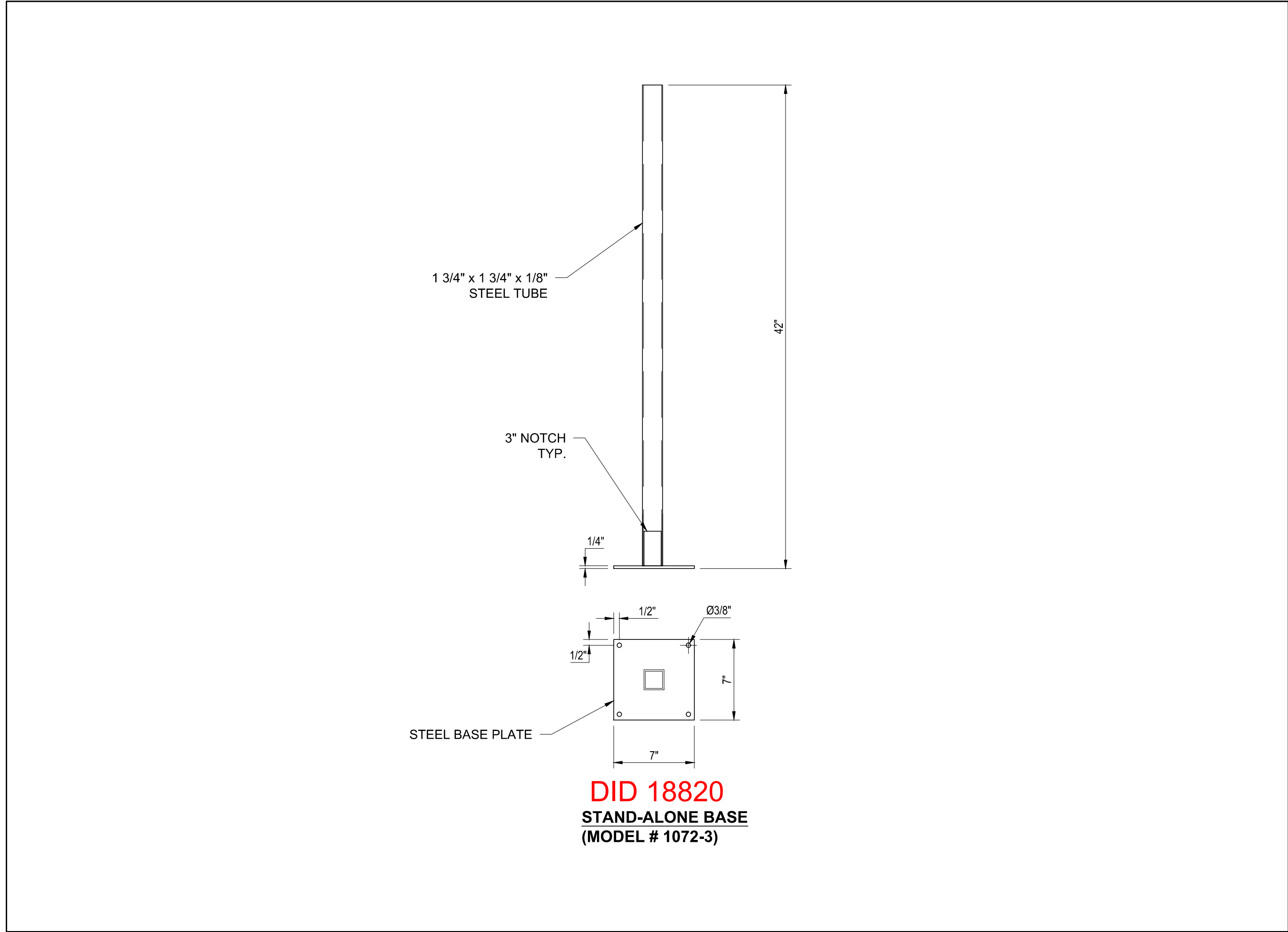
DID 18819
12' POST
(MODEL# 1072-2)




DETAIL A
SCALE: 6"=1'-0"



DETAIL B
SCALE: 6"=1'-0"



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PROJECT NAME: STARBUCKS - LIGHT POLE (OPTIONS)		DESCRIPTION		
DRAWING NAME: STAND ALONE BASE (MODEL # 1072-3)		INITIAL DESIGN		
CUSTOMER: STARBUCKS		REVSIONS PER MARK UPS		
REV	DATE	BY		
IR	08/31/15	PDB		
A	10/02/15	HJB		

SHIPPING ADDRESS:

CONTRACTOR:

CONTACT:
PHONE#:
CELL#:

DWN BY:
PDB

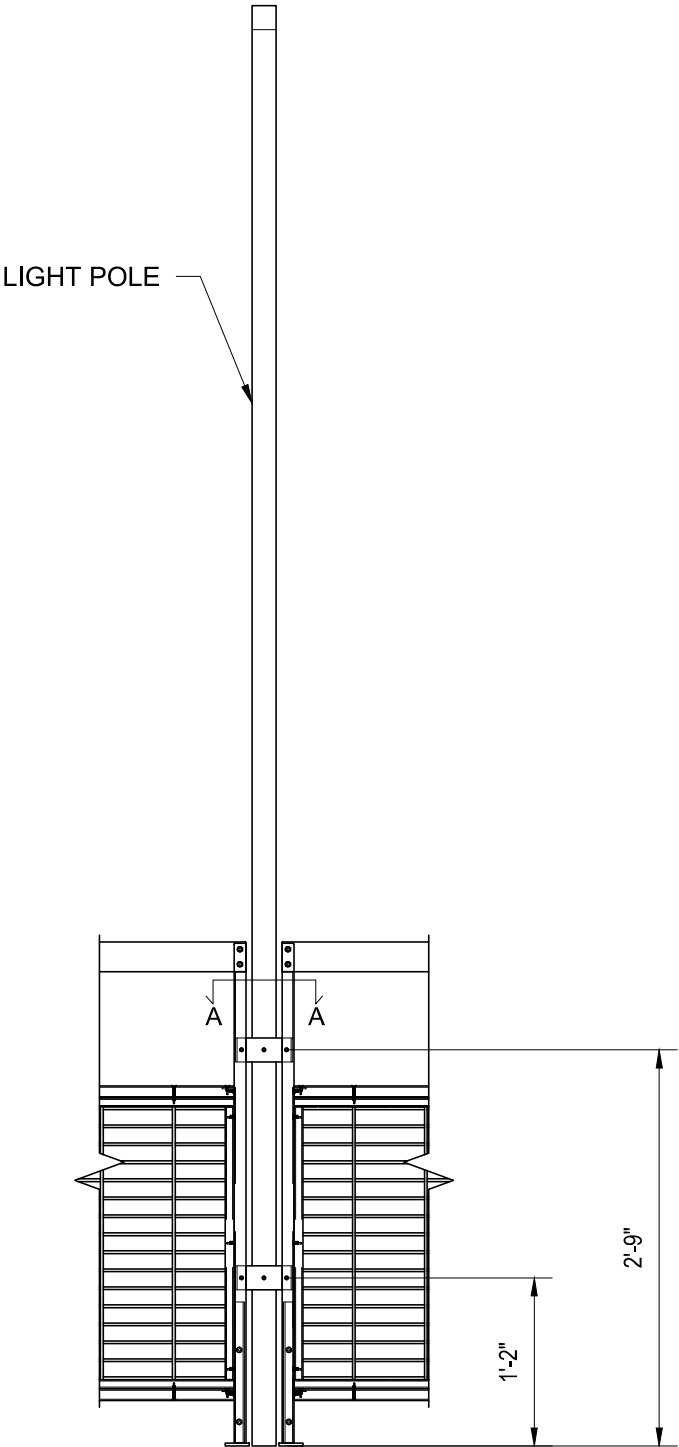
CHK BY:
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ENG. BY:
__

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

SHT. NO: SHT 4

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LIGHT POLE
CONNECTION
(FRONT VIEW)

PROJECT NAME: STARBUCKS - LIGHT POLE (OPTIONS)				DESCRIPTION	
DRAWING NAME: LIGHT POLE CONNECTION TO FENCE				INITIAL DESIGN	
CUSTOMER: STARBUCKS				REVSIONS PER MARK UPS	
REV	DATE	BY			
IR	08/31/15	PDB			
A	10/02/15	HJB			

SHIPPING ADDRESS:

CONTRACTOR:

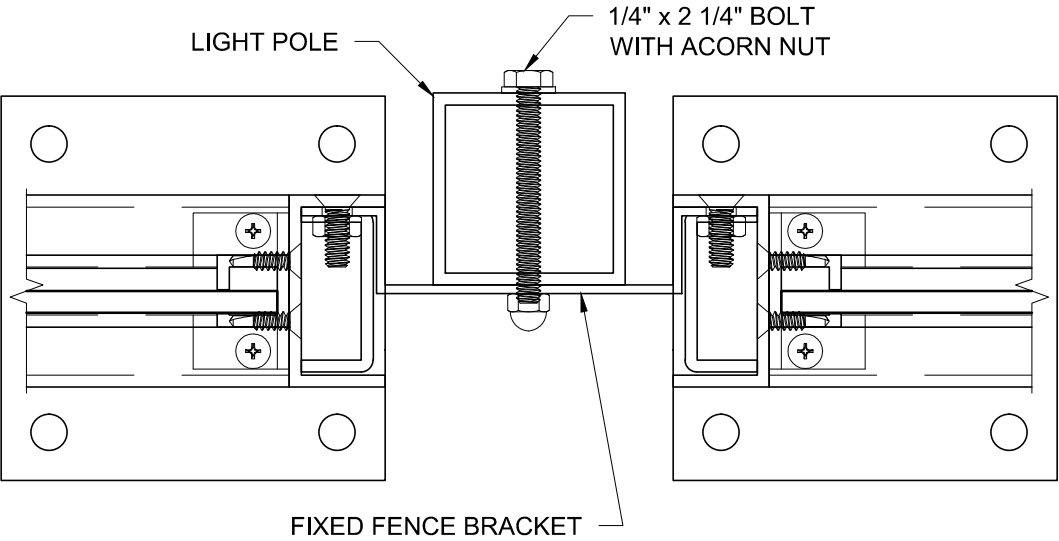
CONTACT:
PHONE#:
CELL#:

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PDB	—	—

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

SHT. NO: SHT 5

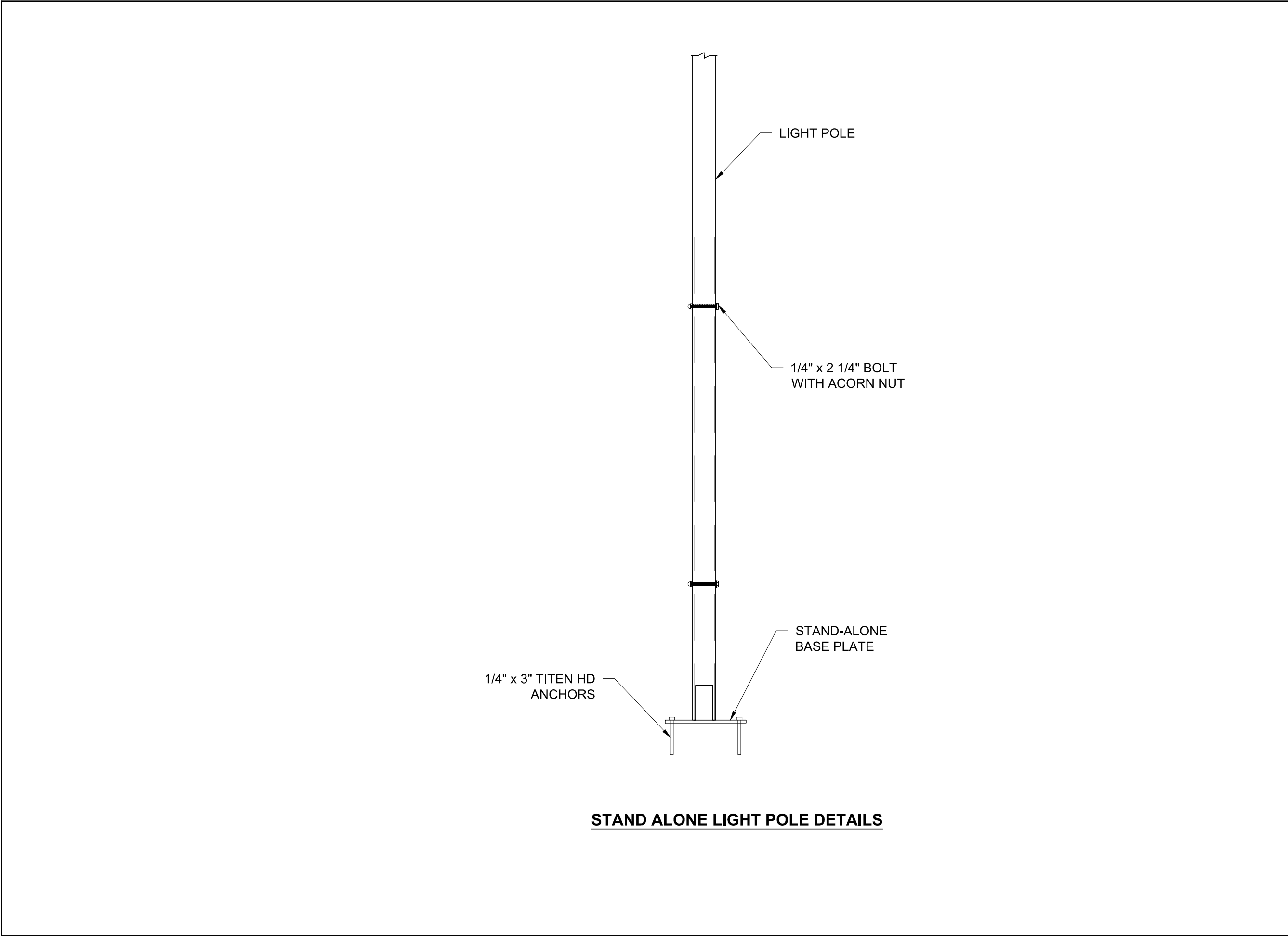
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www.awnexinc.com
Ph. 770-704-7140 Fax 770-704-7647



SECTION A-A


PROJECT NAME: STARBUCKS - LIGHT POLE (OPTIONS)		DATE		BY	DESCRIPTION
		IR	08/31/15	PDB	INITIAL DESIGN
DRAWING NAME: SECTION A-A		DATE		BY	DESCRIPTION
		A	10/02/15	HJB	REVISIONS PER MARK UPS
CUSTOMER: STARBUCKS		DATE		BY	DESCRIPTION
SHIPPING ADDRESS:		DATE		BY	DESCRIPTION
CONTRACTOR:		DATE		BY	DESCRIPTION
CONTACT: PHONE#: CELL#:		DATE		BY	DESCRIPTION
DWN BY:		CHK BY:	ENG. BY:		
PDB					
SCALE:		6"=1'-0"			
SHT. NO:		SHT 6			

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STAND ALONE LIGHT POLE DETAILS

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LEE'S SUMMIT, MISSOURI
07/18/2020


awnexinc.com
Awnings • Canopies • Signs

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www.awnexinc.com
Ph. 770-704-7140 Fax 770-704-7647

PROJECT NAME: STARBUCKS - LIGHT POLE (OPTIONS)				DESCRIPTION	
DRAWING NAME: STAND ALONE LIGHT POLE DETAILS				INITIAL DESIGN	
CUSTOMER: STARBUCKS				REVSIONS PER MARK UPS	
REV	DATE	BY			
IR	08/31/15	PDB			
A	10/02/15	HJB			

SHIPPING ADDRESS:

CONTRACTOR:

CONTACT:
PHONE#:
CELL#:

DWN BY:
PDB

CHK BY:
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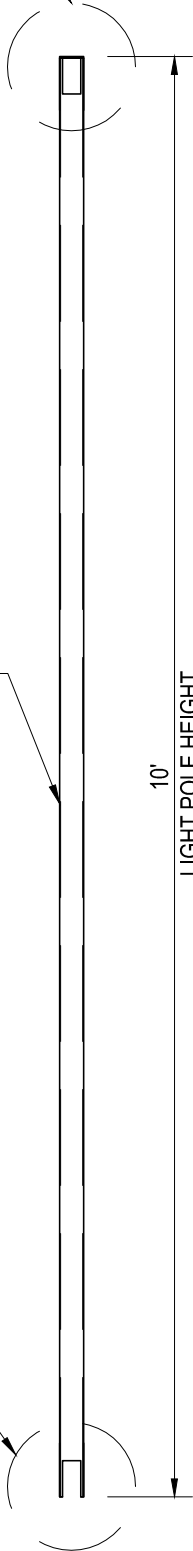
ENG. BY:
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SCALE:
3/4"=1'-0"

SHT. NO:
SHT 7

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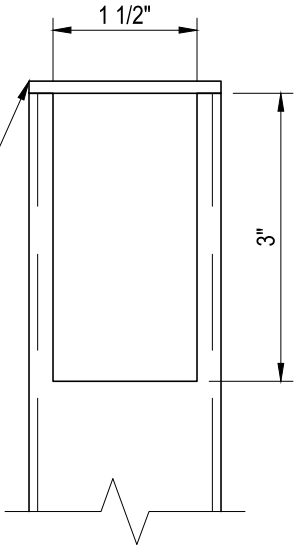
DETAIL A



DID 18818

10' POST
(MODEL# 1072-1)

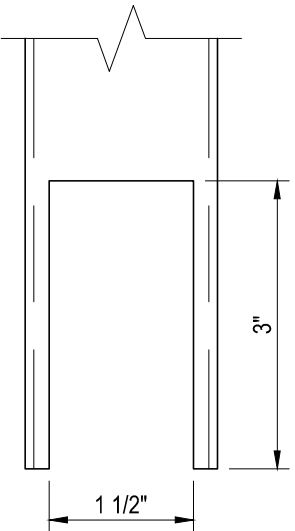
.125" ALUM.
ENDCAP
(WELD
& GRIND
SMOOTH)



SIDE VIEW

OPENING FOR CORD (TOP) DETAIL

DETAIL A
SCALE: 6"=1'-0"



SIDE VIEW

OPENING FOR CORD (BOTTOM) DETAIL

DETAIL B
SCALE: 6"=1'-0"

STARBUCKS - LIGHT POLE (OPTIONS)				STARBUCKS			
10' POST (MODEL# 1072-1)							
PROJECT NAME:	DRAWING NAME:	CUSTOMER:	DESCRIPTION	DATE	BY	INITIAL DESIGN	REVISIONS PER MARK UPS
				08/31/15	PDB		
				10/02/15	HJB		

SHIPPING ADDRESS:

CONTRACTOR:

CONTACT:
PHONE#:
CELL#:

DWN BY:	CHK BY:	ENG. BY:
PDB	—	—

SCALE: 3/4"=1'-0" UNO

SHT. NO:

SHT 2

Ball Ground, Ga. 30107
www.awnexinc.com
Ph. 770-704-7140 Fax 770-704-7647

STARBUCKS - LIGHT POLE (OPTIONS)				STARBUCKS			
12' POLE (MODEL# 1072-2)							
PROJECT NAME:	DRAWING NAME:	CUSTOMER:	DESCRIPTION	DATE	BY	INITIAL DESIGN	REVISIONS PER MARK UPS
				08/31/15	PDB		
				10/02/15	HJB		

SHIPPING ADDRESS:

CONTRACTOR:

CONTACT:
PHONE#:
CELL#:

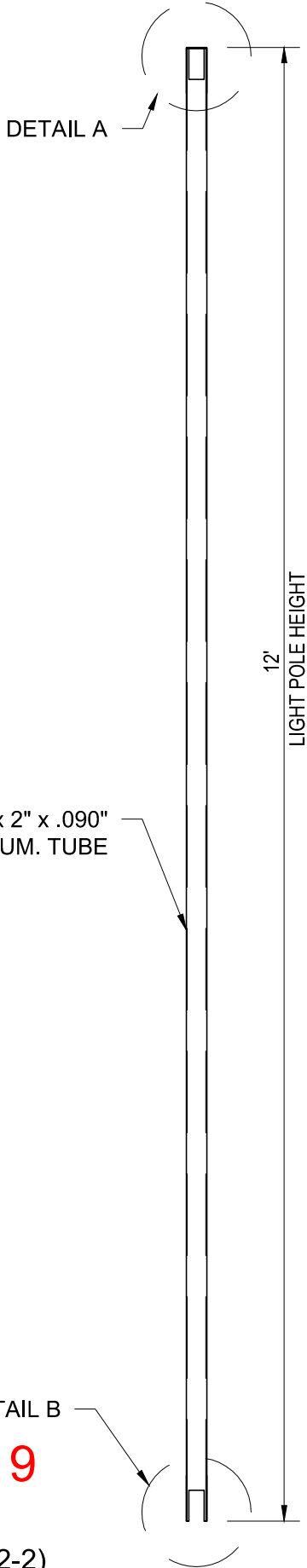
DWN BY:	CHK BY:	ENG. BY:
PDB	—	—

SCALE: 3/4"=1'-0" UNO

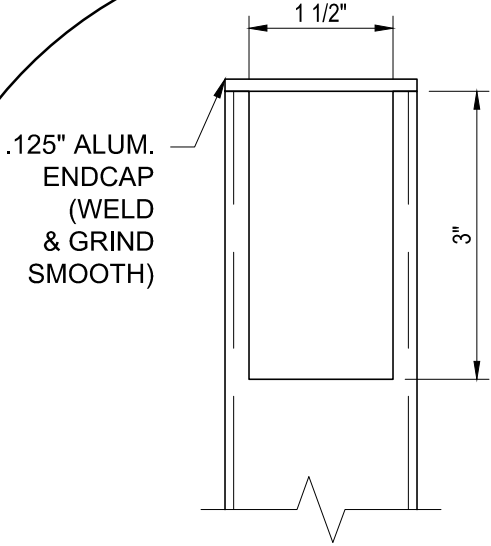
SHT. NO:

SHT 3

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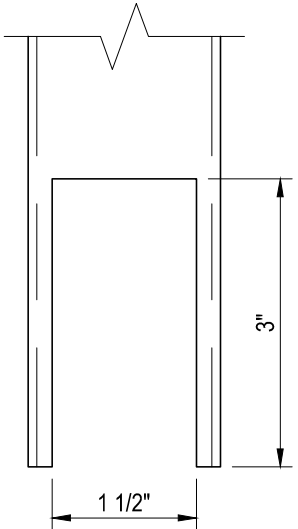


DID 18819
12' POST
(MODEL# 1072-2)



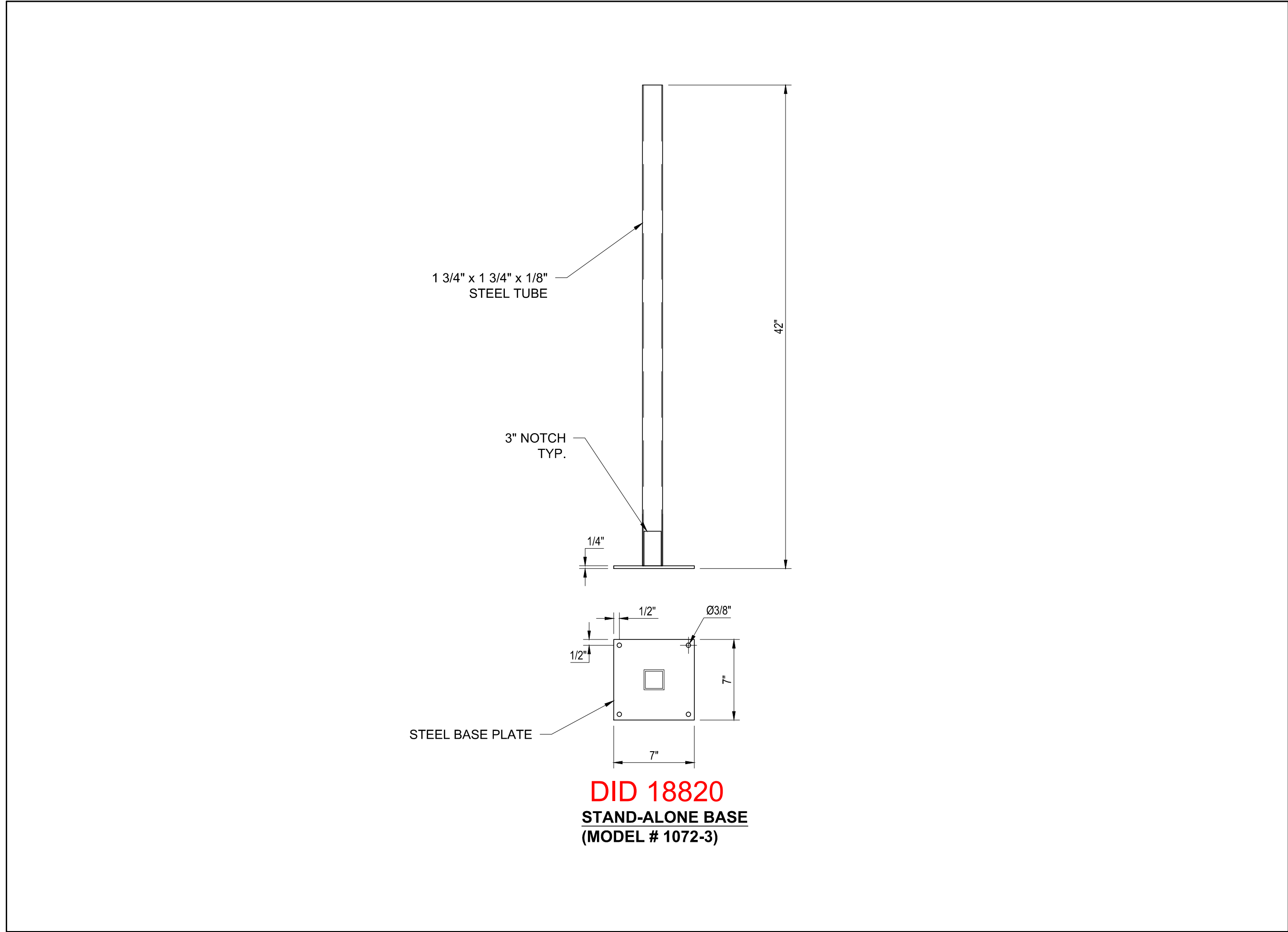
OPENING FOR CORD (TOP) DETAIL

DETAIL A
SCALE: 6"=1'-0"




OPENING FOR CORD (BOTTOM) DETAIL

DETAIL B
SCALE: 6"=1'-0"



RELEASE FOR CONSTRUCTION
AS NOTED ON PLANS REVIEW
DEVELOPMENT SERVICES
LEE'S SUMMIT, MISSOURI
07/18/2020


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STARBUCKS - LIGHT POLE (OPTIONS)

STARBUCKS

STAND ALONE BASE (MODEL# 1072-3)

REV	DATE	BY	DESCRIPTION
IR	08/31/15	PDB	INITIAL DESIGN
A	10/02/15	HJB	REVISIONS PER MARK UPS

PROJECT NAME:

DRAWING NAME:

CUSTOMER:

SHIPPING ADDRESS:

CONTRACTOR:

CONTACT:

PHONE#:

CELL#:

DWN BY:

CHK BY:

ENG. BY:

PDB

SCALE:

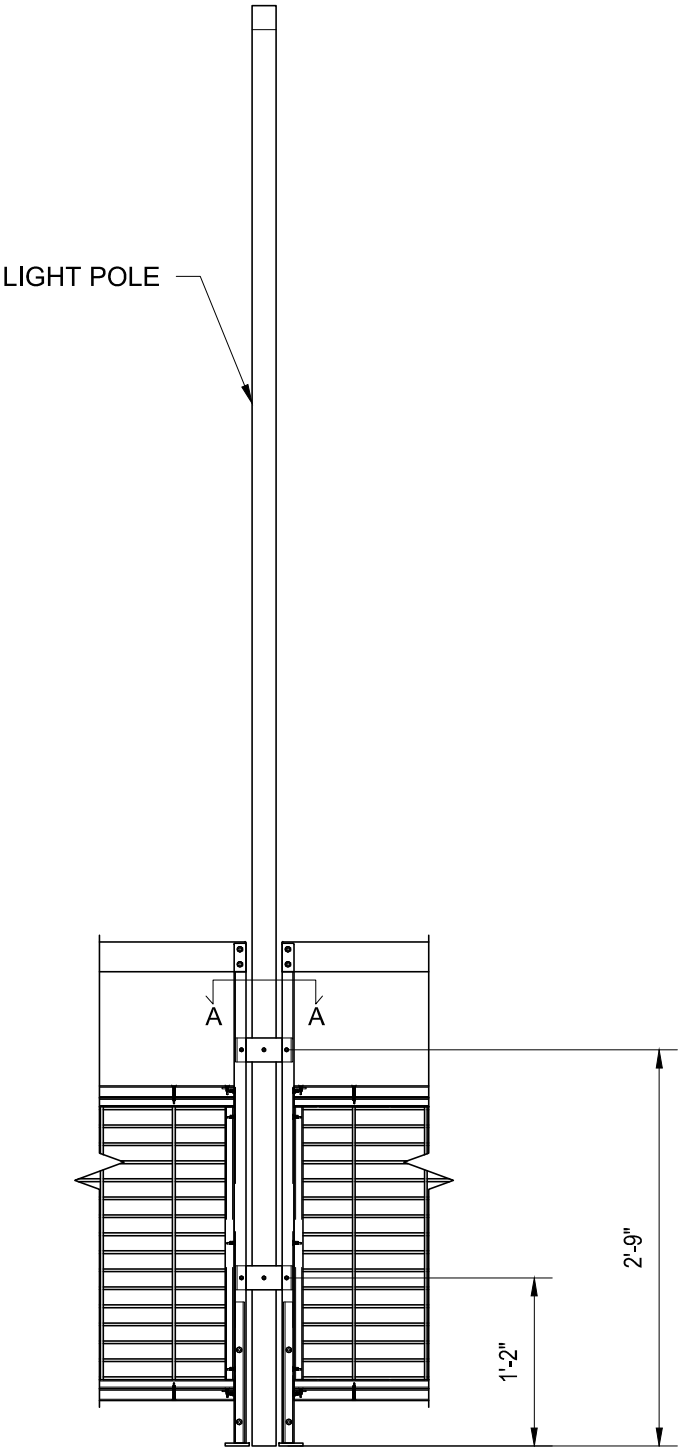
1 1/2"=1'-0"

SHT. NO:

SHT 4

18818, 18819, 18820

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LIGHT POLE
CONNECTION
(FRONT VIEW)

18818, 18819, 18820

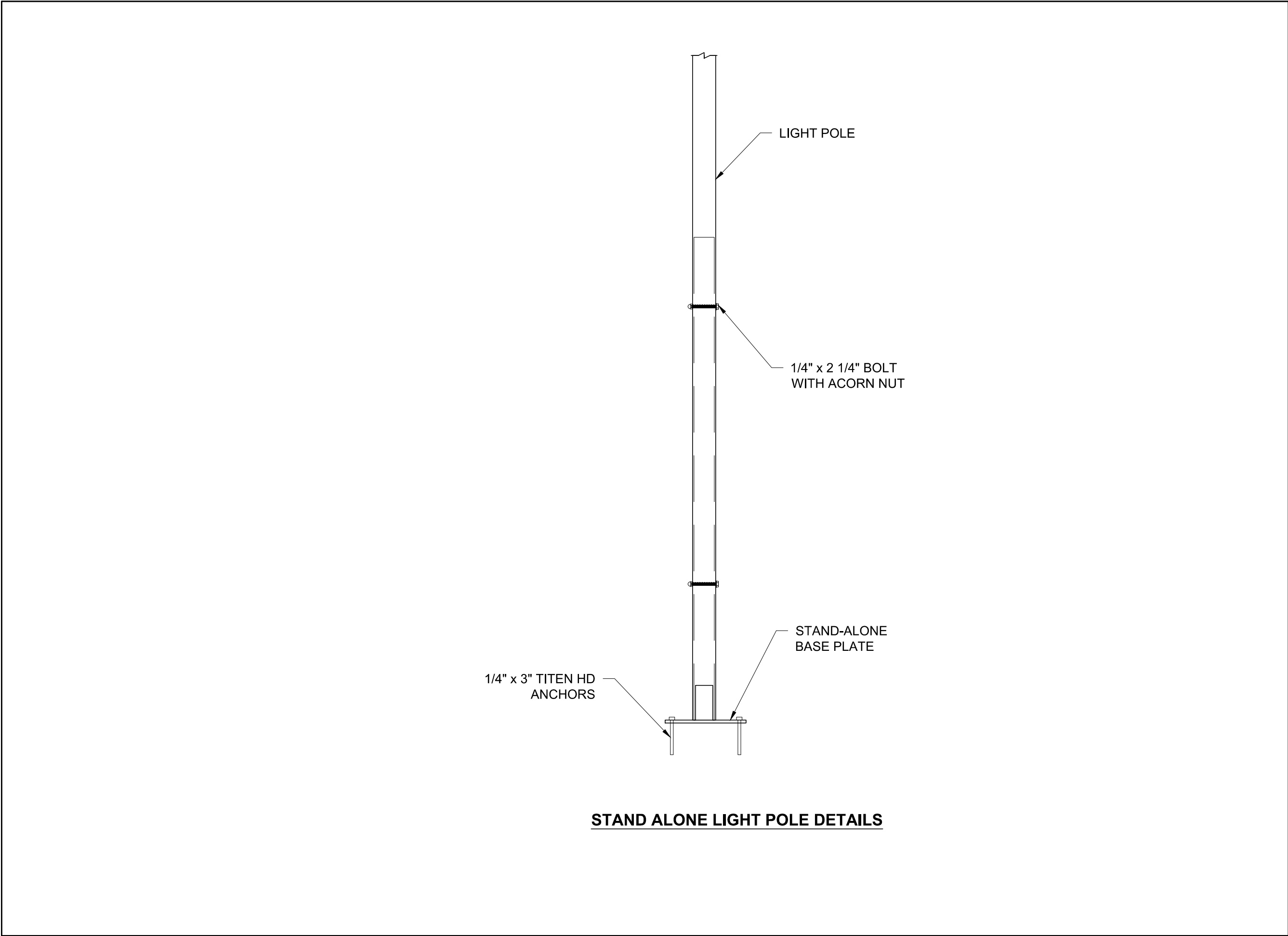
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PROJECT NAME: STARBUCKS - LIGHT POLE (OPTIONS)		DATE		BY	DESCRIPTION
		REV	IR	PDB	INITIAL DESIGN
DRAWING NAME: LIGHT POLE CONNECTION TO FENCE		10/02/15		HUB	REVISIONS PER MARK UPS
CUSTOMER: STARBUCKS					
SHIPPING ADDRESS:					
CONTRACTOR:					
CONTACT:					
PHONE#:					
CELL#:					
DWN BY:	CHK BY:	ENG. BY:			
PDB					
SCALE:		3/4"=1'-0"			
SHT. NO:		SHT 5			

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STAND ALONE LIGHT POLE DETAILS

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PROJECT NAME: STARBUCKS - LIGHT POLE (OPTIONS)				DESCRIPTION	
DRAWING NAME: STAND ALONE LIGHT POLE DETAILS				INITIAL DESIGN	
CUSTOMER: STARBUCKS				REVSIONS PER MARK UPS	
REV	DATE	BY			
IR	08/31/15	PDB			
A	10/02/15	HJB			

SHIPPING ADDRESS:

CONTRACTOR:

CONTACT:

PHONE#:

CELL#:

DWN BY:	CHK BY:	ENG. BY:
PDB		

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

SHT. NO: SHT 7

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20711

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DEVELOPMENT SERVICES
LEE'S SUMMIT, MISSOURI**

07/16/2020



Dolan Hospitality
26 South Hanford St.
Seattle, WA 98134, USA
Toll Free Ph: 888-515-5484
Toll Free Fax: 866-268-1967
info@dolanhospitality.com

	MFR#:	376769
	DESCRIPTION:	Atlantis Outdoor Sconce
	DIMENSIONS:	9" Width, 24" Height
	CERTIFICATION:	UL/CUL
	WET RATED:	No
	TITLE 24:	No
	DARK SKY:	YES
	FIXTURE COLOR:	Black
	SHADE MATERIAL:	Aluminum
	CORD:	N/A
	ADA:	
	WARRANTY:	3 Year
	COUNTRY OF ORIGIN:	China
	COMMENTS:	
	BULB NUMBER:	N/A
	SOCKET TYPE:	Integrated LED
	LAMP TYPE AND SHAPE:	Integrated LED
	FILAMENT SHAPE:	N/A
	WATTAGE:	11
	MAX WATTAGE STICKER:	11
	VOLTAGE:	120
	HERTZ:	60 HZ
	KELVIN TEMP:	2700K
	LUMENS:	900
	BULBS INCLUDED:	Yes

20711

**RELEASE FOR
CONSTRUCTION
AS NOTED ON PLANS REVIEW
DEVELOPMENT SERVICES
LEE'S SUMMIT, MISSOURI**

HINKLEY & R.

HINKLEY LIGHTNING, INC.
33000 PIN OAK PARKWAY | AVON LAKE, OHIO 44012
[PH] 330.653.5500 [F] 440.653.5555
HINKLEYLIGHTNING.com | FREDRICKRAMOND.com

07/16/2020

Large Wall Mount Lantern 1649SK-LED



ITEM NUMBER	1649SK-LED
BRAND	Hinkley Lighting
MATERIAL	Extruded Aluminum
GLASS	Etched Glass Lens
HEIGHT	24.0"
WIDTH	9.0"
LED COLOR TEMP	3000
VOLTAGE	120v
LED LUMENS	900
WATTAGE	11w LED *Included
TITLE	TWENTYFOUR DEC
CERTIFICATION	C-US Wet Rated

FEATURES AND BENEFITS

- Suitable for use in wet (interior direct splash and outdoor direct rain or sprinkler) locations as defined by NEC and CEC. Meets United States UL Underwriters Laboratories & CSA Canadian Standards Association Product Safety Standards
- Meets California Energy Commission 2016 Title regulations
- Fixture is Dark Sky compliant and engineered to minimize light glare upward into the night sky.
- Fixture is ADA compliant and adheres to the standards and guidelines listed by the Americans with Disabilities Act.
- For complete warranty information visit [\(hyperlink\)](#)
- 2 year finish warranty
- LED components carry a 5-year limited warranty
- Bold lines and a clean, minimalist style complement contemporary architecture
- Striking black finish enhances design

FINISH	Satin Black
--------	-------------

AT HINKLEY, WE EMBRACE THE DESIGN PHILOSOPHY THAT YOU CAN MERGE TOGETHER THE LIGHTING, FURNITURE, ART, COLORS AND ACCESSORIES YOU LOVE INTO A BEAUTIFUL ENVIRONMENT THAT DEFINES YOUR OWN PERSONAL STYLE. WE HOPE YOU WILL BE INSPIRED BY OUR COMMITMENT TO KEEP YOUR 'LIFE AGLOW.'

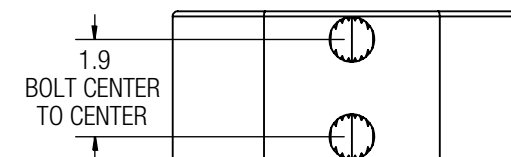
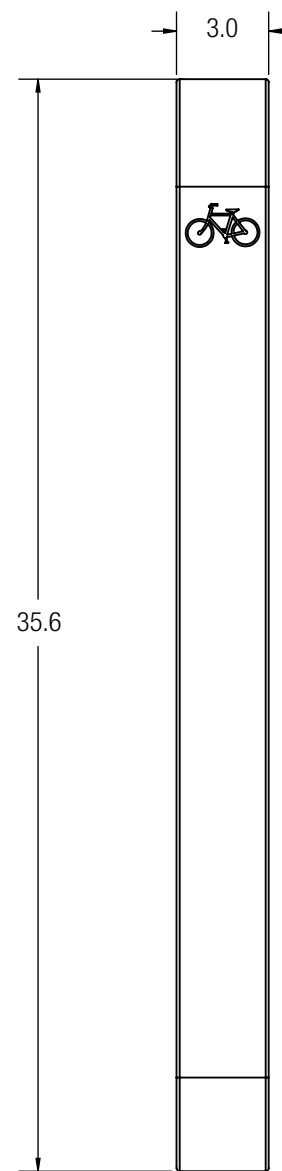
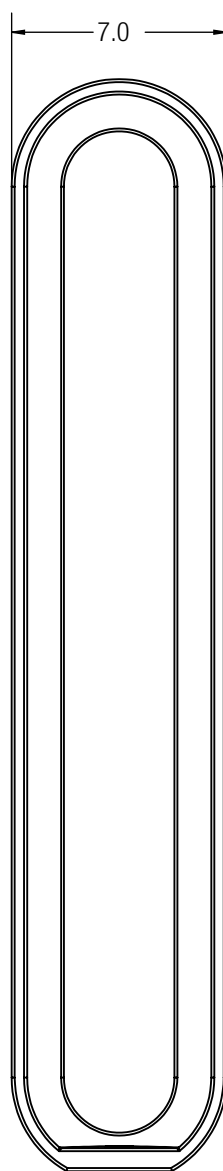
life AGLOW®

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CONSTRUCTION**
AS NOTED ON PLANS REVIEW
DEVELOPMENT SERVICES
LEE'S SUMMIT, MISSOURI

07/16/2020

**RELEASE FOR
CONSTRUCTION**
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DEVELOPMENT SERVICES
LEE'S SUMMIT, MISSOURI

07/16/2020



CUSTOMER APPROVAL:

DATE:

X_____

UNLESS OTHERWISE SPECIFIED,
DIMENSIONS ARE IN INCHES

TOLERANCES (UNLESS OTHERWISE SPECIFIED):
FRACTIONAL: $\pm 1/32$
ANGULAR/BEND: $\pm 1^\circ$
TWO PLACE DECIMAL $\pm .030$
THREE PLACE DECIMAL $\pm .020$

MATERIAL: SEE DATA SHEET

FINISH: SEE DATA SHEET

WEIGHT: 22 LBS

SOURCE: -

SCALE: N.T.S.

FORMS+SURFACES® 30 Pine Street, Pittsburgh, PA 15223
Tel (800) 451-0410 Fax (412) 781-7840

FORMS+SURFACES®

FORMS+SURFACES® 30 Pine Street, Pittsburgh, PA 15223
Tel (800) 451-0410 Fax (412) 781-7840

		DATE
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		01/01/2011
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OLYMPIA BIKE RACK
SKOLY

SIZE	
------	--

B

DWG. NO.

SKOLY-CS

REV

0

SHEET

1 OF 1

FEATURES

HOUSING — Rear housing is rugged, corrosion-resistant, die-cast aluminum. Corrosion-resistant external hardware includes slotted hex-head and tamper-proof fasteners. Finish is dark bronze thermoset polyester powder, electrostatically applied.

BALLAST — High-reactance, high power factor. Encased-and-potted solid-state ignitors. Ballast is copper wound and 100% factory tested. Meets ANSI standards and is UL listed. Electrical components are mounted on back housing. (For 50 hertz availability, consult factory).

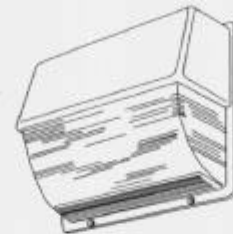
OPTICS — Reflector is finished in white thermoset polyester powder, electrostatically applied. Front housing and refractor are one-piece, injection-molded, UV-stabilized polycarbonate. Standard finish on opaque portion of front cover and back housing is dark bronze polyester enamel. Refractor is sealed and gasketed to inhibit the entrance of outside contaminants.

INSTALLATION — Top 3/4" threaded wiring access. Back access through removable 3/4" knockout. Feed-thru wiring can be achieved by using a conduit tee. Mount on any flat vertical surface.

SOCKET — Porcelain, horizontally-oriented, medium-base socket with copper alloy, nickel-plated screw shell and center contact. UL listed 660W, 600V and 4KV pulse rated.

LISTING — UL listed suitable for wet locations. Listed and labeled to comply with Canadian and Mexican Standards (see Options). IP64 rated in accordance with IEC Standard 529.

NOTE: Not recommended for use in car wash interior applications.



Height: 15-7/16" (39.2cm)
Width: 16-1/8" (41cm)
Depth: 7-3/4" (19.7cm)
Weight: 14 to 15 lbs. (6 to 7 kg)

ORDERING INFORMATION

Choose the **boldface** catalog nomenclature that best suits your needs and write it on the appropriate line. Order accessories as separate catalog numbers (shipped separately).

Example: TWP 70S 120

TWP			Options	
Series	Wattage /lamp	Voltage		
TWP		120	Shipped installed in fixture	
	35S	208 ¹	SF	Single fuse (120, 277, 347V) ⁵
	50S	240 ³	DF	Double fuse (208, 240, 480V) ⁵
	70S	277	EC	Emergency circuit ^{6,7}
	100S	347	QRS	Quartz restrike system ^{6,7}
	150S ^{1,2}	480 ³	CR	Corrosion-resistant finish (housing only)
		TB ⁴	CRT	Corrosion-resistant finish (Teflon) ⁸
			PE	Photoelectric cell, button type ²
			LPI	Lamp (shipped in carton with fixture)
			IS	Integral slipfitter
			FS	Full shield
			WG	Wireguard
			RHP	Reactor high power factor ballast
			RNP	Reactor normal power factor ballast
			XHP	Reactance high power factor ballast
			Architectural Colors (optional)	
			DBL	Black
			DMB	Medium bronze
			DWH	White
			CSA	Listed and labeled to comply with Canadian Standards
			NOM	Listed and labeled to comply with Mexican Standards (Consult factory)

Accessories	
Order as separate catalog number.	
RK1 PEB1	Photoelectric control kit (120V)
RK1 PEB2	Photoelectric control kit (277V)
RK1 PEB3 CSA	Photoelectric control kit (347V)
PE3	NEMA twist-lock photocontrol (347V)
PE4	NEMA twist-lock photocontrol (480V)

NOTES:

- 1 Operates 55V lamp.
- 2 Not available 480V.
- 3 Not available in Canada.
- 4 Optional multi-tap ballast - 120, 208, 240, 277V (120, 277, 347V in Canada).
- 5 Not available with multi-tap ballast.
- 6 Lamp not included.
- 7 Quartz lamp wattage not to exceed ballast wattage rating.
- 8 Black finish on housing only.



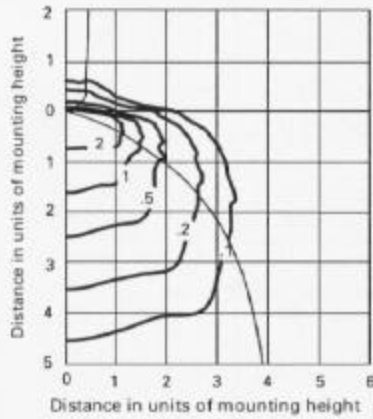
TWP S1

TWP High Pressure Sodium Wall-Paks

Coefficient of Utilization _____
Initial Footcandles _____

TWP 70S Test Report no. 94121702

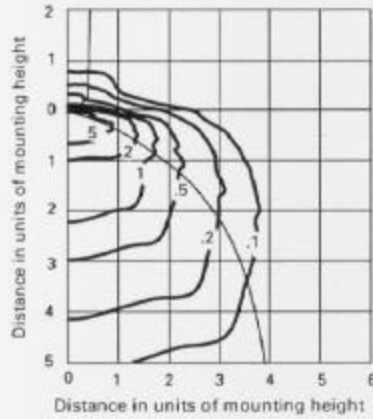
Coefficients of utilization



70W, high pressure sodium lamp, horizontal lamp orientation, 12' mounting height, 6,300 rated lumens. **Total fixture efficiency: 55%**

TWP 100S Test Report no. 94121502

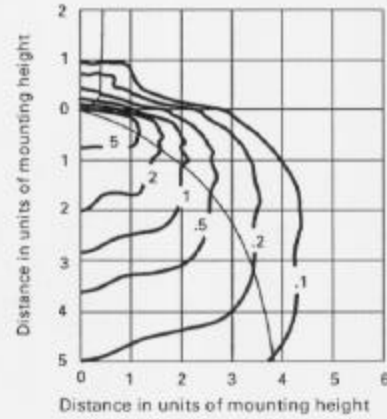
Coefficients of utilization



100W, high pressure sodium lamp, horizontal lamp orientation, 12' mounting height, 9,500 rated lumens. **Total fixture efficiency: 55%**

TWP 150S Test Report no. 94121503

Coefficients of utilization



150W, high pressure sodium lamp, horizontal lamp orientation, 12' mounting height, 16,000 rated lumens. **Total fixture efficiency: 53.4%**

Mounting Height Correction Factor

(Multiply the fc level by the correction factor)

10 ft. = 1.44
15 ft. = .64
20 ft. = .36
25 ft. = .23

TWP S1

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TWPS1.P65



General Purpose Outdoor Lighting - P.O. Box A, Conyers, GA 30012, 770-922-9000, Fax 770-483-2635
www.lithonia.com - In Canada: 1100 50th Ave., Lachine, Quebec H8T 2V3