Project Manual

VOLUME 2 0F 3

CSM CIP2 BUILDING 5N PROJECT
COLLEGE OF SAN MATEO

San Mateo, CA

Regulatory Submittal
June 13, 2008

Developed for:
College of San Mateo
San Mateo, CA

Project Manual

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San Mateo, CA

- SECTION 00005 -

PROJECT DIRECTORY

OWNER

SMCCCD
1700 W. Hillsdale Boulevard
San Mateo, CA 94402
Contact: Joe Millsaps
Tel: (650) 358-6785
Fax: (650) 358-6837

CONTRACTOR

MCCARTHY BUILDING COMPANIES
343 Sansome, 14th Floor
San Francisco, CA 94104
Contact: Bill Niemann, Project Director
Tel: (415) 364-1339
Fax: (415) 397-5999

(seal)

ARCHITECT

KWAN HENMI ARCHITECTURE/PLANNING.
456 Montgomery St., Suite 300
San Francisco, CA 94104
Contact: Denis Hemni, AIA, License #C11009
Tel: (415) 777-4770
Fax: (415) 777-5102

(seal)

CIVIL ENGINEER

BKF ENGINEERS
255 Shoreline Dr., Suite 200
Redwood City, Ca. 94065
Contact: Roland Haga, P.E.
Tel: (650) 482-6300
Fax: (650) 482-6399

(seal)

STRUCTURAL ENGINEER

FORELL ENGINEERING
160 Pine Street, 6th Floor
San Francisco, CA 94111
Contact: Paul Rodler, S.E.
Tel: (415) 837-0700
Fax: (415) 837-0800

(seal)

PLUMBING ENGINEER

JW MCCLENAHAN CO.
2301 Palm Avenue
San Mateo, CA 94403
Contact: Todd Kuchta, P.E.
Tel: (650) 345-1691
Fax: (650) 345-5681

(seal)

MECHANICAL ENGINEER (DESIGN / BUILD)

WESTERN ALLIED MECHANICAL
1180 O'Brien Drive
Menlo Park, CA 94025
Contact: Laurens Vaneveld
Tel: (650) 326-0750
Fax: (650) 321-4946

(seal)

ELECTRICAL ENGINEER (DESIGN / BUILD)

ROSENDIN ELECTRIC
880 N. Mabury Rd.
San Jose, CA 95133
Contact: Bill Mazzetti
Tel: (408) 534-2833
Fax: (408) 808-1979

(seal)

FIRE PROTECTION

TRANSBAY FIRE PROTECTION
2182 Rheem Drive
Pleasanton, CA 94588
Contact: Charles Marlin
Tel: (925) 846-9484
Fax: (925) 846-9710

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ROLF JENSEN & ASSOCIATES, INC.
FIRE PROTECTION CONSULTANTS

2125 Oak Grove Road
Suite 300
Walnut Creek, CA 94598-2539 USA
www.rjainc.com
+1 925-938-3550
Fax: +1 925-938-3818

June 11, 2008

Via E-mail: jharvey@mccarthy.com

Mr. James Harvey
McCarthy Building Companies, Inc.
343 Sansome St. 14th Floor
San Francisco, CA 94104

COLLEGE OF SAN MATEO, BUILDING 5N
REVIEW OF TRANSBAY FIRE PROTECTION, INC.
DSA SUBMITTAL PACKAGE

Dear Mr. Harvey:

As was requested by McCarthy Building Companies, Inc., Rolf Jensen & Associates, Inc. (RJA) has completed a review of the Transbay Fire Protection, Inc. DSA submittal package for the College of San Mateo, Building 5N. RJA was provided ftp site access to download the DSA submittal package on June 4, 2008. An additional drawing was sent to RJA via e-mail on June 5, 2008. The submittal package contained automatic fire sprinkler drawings, hydraulic calculations, seismic bracing calculations, and product catalog data sheets. These drawings and calculations were reviewed for conformance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2002 Edition. The catalog data sheets were reviewed against the project specifications, *Wet-Pipe Sprinkler Systems Specification 21 1313.* The following items have been identified by RJA as potential sources for DSA comments. RJA discussed a majority of these items during a telephone conversation on June 9, 2008 with Transbay Fire Protection, Inc. It is recommended to correct these items prior to submittal to DSA to reduce the potential for DSA comments:

1. The seismic loading calculations, included in the hydraulic overview, reference the 1999 Edition of NFPA 13, Sections 6-4.5.8 and 6-4.5.9. RJA recommends that these calculations be updated to conform to the applicable code, the 2002 Edition of NFPA 13.

2. The hydraulically remote areas in Drawings FP-2.1 and FP-2.5 do not show the hydraulic node designators close to the node that they represent. It is recommended that node designators be placed closer to the nodes that they represent for clarity.

3. It is recommended that the location of the building, including street address, should be included on the drawings per NFPA 13 (2002 Edition) Section 14.1.3(2).

4. It is recommended to show the location, size, water supply test data, system elevation relative to the test hydrant, and point-of-connection with the city (campus) main on the Site Plan and General Notes Drawing(s).

5. The sprinkler information tables were not consistent on every drawing. On several of the drawings, the Sprinkler Legend contained symbols that were not used in the drawings. For example, Drawing FP-1.2 does not show any sprinkler locations, but it includes information for TY3131 type sprinklers. On the same drawing, the Sprinkler Symbol Legend does not include any sprinkler symbols. Another example occurs on Drawing FP-2.1 where the symbol used in the Sprinkler Head Information Table for the TY5137 is not shown in the Sprinkler Head Symbols Legend. It is recommended that the Sprinkler Head Symbols Legend and the Sprinkler Head Information Table all have essential information included for each page, and it is also recommended that they are consistent with each other.

6. It is recommended that the total area protected by each system on each floor be shown somewhere on the drawings in order to conform to NFPA 13 (2002 Edition) Section 14.1.3(14).

7. The standpipe riser shown in Stair 3 on Drawing FP-2.2, Level 1 East Piping Plan is not shown on the Level 2 East Piping Plan or the Level 3 East Piping Plan.

8. It is recommended to clearly identify the backflow preventer and fire department connection on Drawing FP-1.0 Site Plan and General Notes.

9. Even though hose outlets are not required for this project, they have been added to one of the stairs. It is recommended that these devices be clearly shown and identified on the drawings.

10. A symbol for “End of Line Restraint” is shown in the Standard Symbols Legend, but no end of line restraints are shown on any of the drawings. NFPA 13 (2002 Edition) Section 9.3.6.3 states that *“the end sprinkler on a line shall be restrained against excessive vertical and lateral movement.*” It is recommended that the

sprinkler contractor confirm that end of line restraints are not needed or show them on the drawings.

11. Products from Merit Manufacturing and WAMI Sales, Inc. are included in the product data submittal. It is recommended that the fire sprinkler contractor confirm that Merit Manufacturing and WAMI Sales, Inc. are approved manufacturers.

12. TY3231 type sprinklers are not approved by Factory Mutual Research Corporation (FM) as quick-response sprinklers, and TY5137 type sprinklers are not approved by FM as quick-response sprinklers for a Light Hazard classification. It is recommended to confirm the requirement for FM approval on this project, and modify the automatic fire sprinklers to match the required approval and listings.

In conclusion, these items have been identified by RJA as recommended corrections. If you have any questions regarding the above-mentioned items, please contact either John Stauder or myself.

Prepared by:

ROLF JENSEN & ASSOCIATES, INC.

Marcus D. Berona 6/11/08
Marcus D. Berona Date

Reviewed by:

ROLF JENSEN & ASSOCIATES, INC.

6/11/08
John R. Stauder, P.E. Date

MDB/JRS:ga
S45505\LTGA0337REV

cc: Randy Ralston / Transbay Fire Protection / randy@transbayfire.com
Faraaz Mirza / Kwan Henmi / faraaz.mirza@kwanhenmi.com
John Stauder / RJA

TRANSBAY FIRE PROTECTION, INC.

License No. 629778 • EEO

Annotated Response Letter

Date: 6-11-08
Job Name: CSM 5N Transbay Job #: 824
Comments by: John R. Stauder, P.E.

#	SHEET	COMMENT	RESPONSE
1	n/a	Seismic loading calculations	References have been changed to NFPA 13 (2002)
2	FP-2.1 FP-2.5	Hydraulic node locations	Clarified as requested
3	n/a	Building location	See sheet FP-1.0 for site plan
4	n/a	Water supply information	See sheet FP-1.0
5	All	Sprinkler information	Revised as requested
6	n/a	Area	See sheet FP-1.0
7	FP-2.3 FP-2.5	Standpipe riser location	Location shown as requested
8	n/a	FDC & BFP	See sheet FP-1.0 for location
9	FP-2.2 FP-2.4 FP-2.6	Hose outlets	Hose outlets are in fire hose cabinets. Cabinets are shown on drawings and designated as 'FHC'
10	All	Standard Symbols Legend	All symbols in legend are not required to be used. End of line restraints are not required per NFPA 13 (2002) 1.5 & NFPA 13 (2007) 9.3.6.5
11	n/a	Product Data	Confirmed and updated as requested
12	n/a	Sprinkler heads	Comment incorrect for the application used on this project

If there should be any additional concerns regarding this re-submittal, please contact me.

Thank you,

Randy Ralston
Project Manager

2539 Del Monte Street
Sacramento, CA 95620
Ph (916) 376-0317
Fax (916) 376-9485

Corporate Office
2182 Rheem Drive
Pleasanton, CA 94588
Ph (800) 870-7377
Fax (925) 846-9710

4672 W. Jennifer Avenue #101
Fresno, CA 93722
Ph (559) 276-6076
Fax (559) 276-6282

BkF
ENGINEERS
SURVEYORS
PLANNERS

College of San Mateo
Building 5 (B5N) Fire System Narrative

June 12, 2008

Existing Fire System

The College of San Mateo combined fire and domestic water main is a looped campus-wide system servicing the campus' fire and water demand. Fire demand for campus buildings are serviced through fire laterals off the existing 8" main campus loop. For the campus fire and water system flows and pressures, refer to attached CSM Fire Hydrant data and CSM Fire Department Map.

Building 5 (B5N) Fire System

BKF Engineers has provided a new 6" fire service lateral off of the existing 8" fire/water campus loop at the south end of B5N adjacent to Parking Lot 3. The lateral incorporates a double check detector backflow, fire department connection and post indicator valve for the San Mateo Fire Department. The 6" fire lateral connects to the B5N fire system at the southwest corner of the building. Fire Flow calculations for B5N have been analyzed and are provided by Transbay Fire Protection, Inc.

Site Fire Analysis

The College of San Mateo fire/water system has been upgraded since 2005. Upgrades include design and installation of new fire booster pumps. As part of the improvements, the campus fire system was analyzed as part of the CSM Fire Pump Replacement Documents. Please refer to submitted and approved documents under Department of State Architects (DSA) Application Number 106069-II, dated May 26, 2005. For reference, attached is Project Notice of Completion Documentation, dated October 25, 2006 and recorded October 30, 2007.

255 Shoreline Drive
Suite 200
Redwood City
California 94065
phone 650.482.6300
fax 650.482.6399
www.bkf.com

cc: Faraaz Mirza, Kwan Henmi Architects

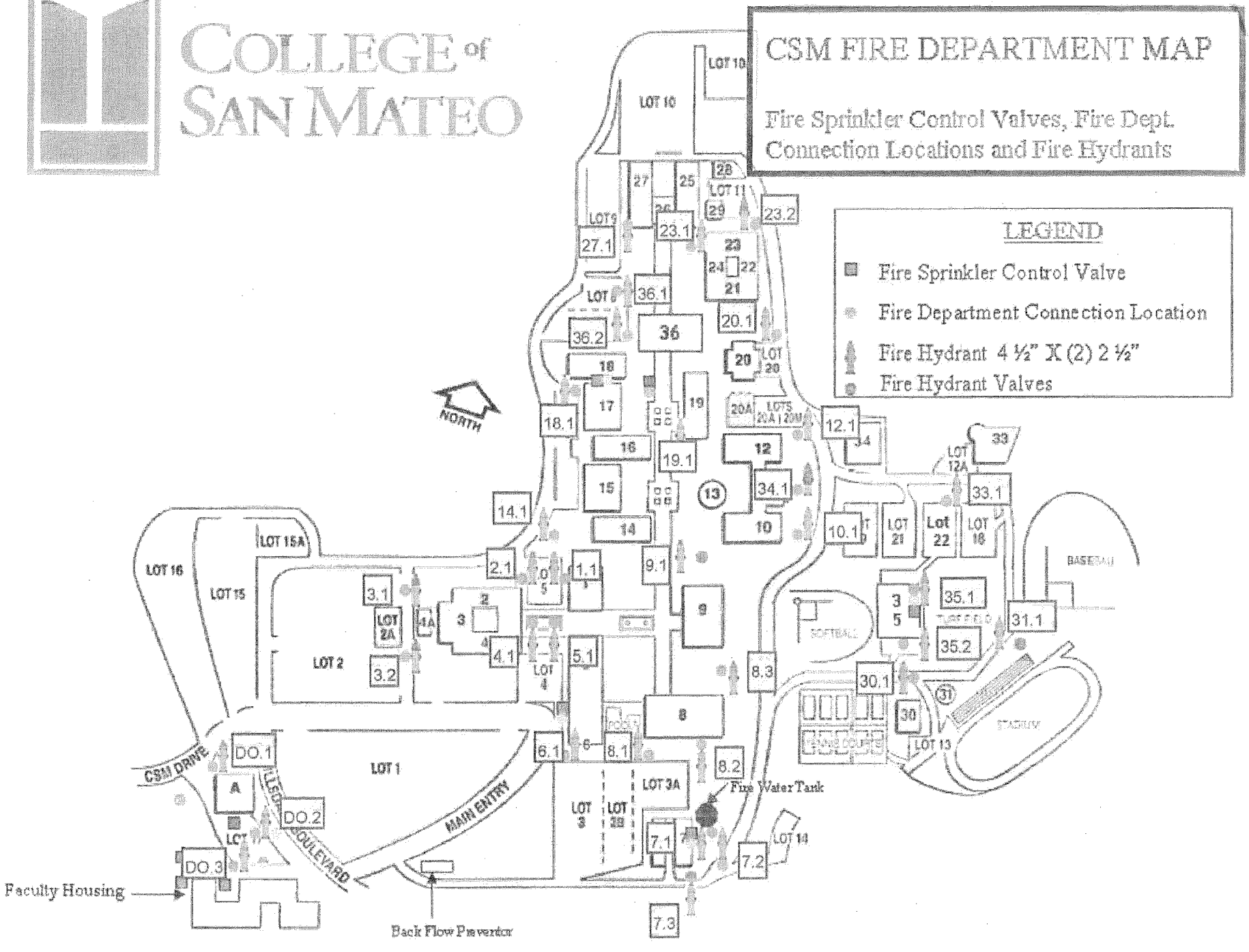
CSM Fire Hydrant April 2007

CSM Hydrant Labeling	Test Date	Start Time	Measured Pitot Pressure (psi)	Calc'd Hydrant Flow (gpm)	Static Pressure (psi)	Residual Pressure (psi)	Calc'd Max GPM Available @20psi	
FH1.1	4/2/2007	8:08	82	1525	110	100		
FH2.1	4/2/2007	7:40	86	1550	99	91		
FH3.1	4/2/2007	7:30	70	1405	102	92		
FH3.2	4/4/2007	6:34	70	1405	120	104		
FH4.1	4/4/2007	6:25	86	1550	120	102		
FH5.1	4/3/2007	10:52	90	1590	120	110		
FH6.1	4/3/2007	10:40	92	1605	120	110		
FH7.1	Tank Suction							
FH7.2	4/4/2007	8:05	28		39	29	Hydrant on city main	
FH7.3	4/4/2007	6:45	25		39	29	Hydrant on city main	
FH8.1	4/3/2007	10:46	92	1605	120	110		
FH8.2	4/3/2007	10:34	95	1635	120	110		
FH8.3	4/3/2007	9:12	85	1550	110	100		
FH9.1	4/3/2007	9:30	87	1570	110	100		
FH10.1	4/2/2007	11:54	80	1500	106	98		
FH12.1	4/2/2007	11:20	78	1490	104	98		
FH14.1	4/2/2007	8:14	80	1500	103	94		
FH18.1	4/2/2007	8:21	74	1450	112	100		
FH19.1	4/2/2007	11:47	72	1430	106	100		
FH20.1	4/2/2007	10:59	90	1590	106	98		
FH23.1	4/2/2007	8:59	90	1590	122	106		
FH23.2	4/2/2007	9:18	90	1590	116	100		
FH27.1	4/2/2007	8:51	81	1505	120	108		
FH30.1	4/3/2007	8:59	97	1660	120	110		
FH31.1	4/3/2007	8:47	97	1660	142	120		
FH33.1	4/2/2007	12:00	85	1550	129	118		
FH34.1	4/2/2007	11:36	82	1510	116	98		
FH35.1	4/2/2007	12:16	97	1635	128	116		
FH35.2	4/2/2007	12:11	92	1600	128	116		
FH36.1	4/2/2007	8:43	82	1525	120	108		
FH36.2	4/2/2007	8:38	80	1500	114	100		
FHDO.1	4/4/2007	7:43	26		45	38	Hydrant on city main	
FHDO.2	4/4/2007	7:34	28		39	28	Hydrant on city main	
FHDO.3	4/4/2007	7:20	26		37	28	Hydrant on city main	

COLLEGE of SAN MATEO

CSM FIRE DEPARTMENT MAP

Fire Sprinkler Control Valves, Fire Dept. Connection Locations and Fire Hydrants



RECORDING REQUESTED BY
AND WHEN RECORDED MAIL TO:

NAME San Mateo County Community College District Facilities & Operations

STREET ADDRESS 3401 CSM Drive

CITY San Mateo

STATE CA

ZIP 94402

Title Order No. _____ Escrow No. _____

2007-158305
04:19pm 11/02/07 NC Fee: NO FEE
Count of pages 1
Recorded in Official Records
County of San Mateo
Warren Slocum
Assessor-County Clerk-Recorder

* 2 0 0 7 0 1 5 8 3 0 5 A R *

SPACE ABOVE THIS LINE FOR RECORDER'S USE

Gov't Code 6103
Exempt From Recording Fee

NOTICE OF COMPLETION

Notice pursuant to Civil Code Section 3093, must be filed within 10 days after completion. (See reverse side for Complete requirements.)

Notice is hereby given that:

1. The undersigned is owner or corporate officer of the owner of the interest or estate stated below in the property hereinafter described:
2. The full name of the owner is: San Mateo County Community College District
3. The full address of the owner is: 3401 CSM Drive, San Mateo, CA 94402
4. The nature of the interest or estate of the owner is: In fee.

(IF OTHER THAN FEE STRIKE "IN FEE" AND INSERT, FOR EXAMPLE, "PURCHASER UNDER CONTRACT OR PURCHASE," OR "LESSEE")

5. The full names and full addresses of all persons, if any, who hold title with the undersigned as joint tenants or as tenants in common are:

NAMES ADDRESSES

N/A

6. The full names and full addresses of the predecessors in interest of the undersigned, if the property was transferred subsequent to the commencement of the work or improvements herein referenced to:

NAMES ADDRESSES

N/A

7. A work of improvement on the property hereinafter described was completed on 10/25/06 The work done was: College of San Mateo Fire Pump Replacement Project
8. The name of the contractor, if any, for such work of improvement was Transbay Fire Protection, Inc. 9/26/05

(IF NO CONTRACTOR FOR WORK OF IMPROVEMENT AS A WHOLE, INSERT "NONE") (DATE OF CONTRACT)

9. The property on which said work of improvement was completed is in the City of San Mateo

County of San Mateo State of CA And is described as follows: College of San Mateo

10. The street address of said property is 1700 Hillsdale Blvd., San Mateo, CA 94402

Dated: 10/30/07

(SIGNATURE OF OWNER OR CORPORATE OFFICER OF OWNER NAMED IN PARAGRAPH 2 OR HIS AGENT)

José Nuñez

VERIFICATION

I, the undersigned, say; I am the Vice Chancellor of Facilities Planning, M & O the declarant of the foregoing notice of completion;

("PRESIDENT OF", "MANAGER OF", "PARTNER OF", "OWNER OF", ETC.)

I have read said notice of completion and know the contents thereof; the same is true of my own knowledge. I declare under penalty of perjury that the foregoing is true and correct.

Executed on 10/30, 07, at San Mateo (CITY), CA (STATE)

(PERSONAL SIGNATURE OF THE INDIVIDUAL WHO IS SWEARING THAT THE CONTENTS OF THE NOTICE OF COMPLETION ARE TRUE.)

José Nuñez

ORIGINAL

Hydraulic Overview

Job

Job Number: 824	Design Engineer:
Job Name: College of San Mateo Building 5N	Phone: / FAX:
Address 1:	State Certification/License Number:
Address 2:	AHJ:
City: San Mateo / State: CA / Zip Code:	Job Site: Building 5N

System

Density: 0.150gpm/ft²	Area of Application: 1500.00ft² (Actual 1530.11ft²)
Most Demanding Sprinkler Data: 5.6 K-Factor 19.50 at 12.125	Hose Streams: 250.00
Coverage Per Sprinkler: 130.00ft²	Number Of Sprinklers Calculated: 17
System Pressure Demand: 50.240	System Flow Demand: 354.80
Total Demand: 604.80 @ 50.240	Pressure Result: +68.116 (57.6%)

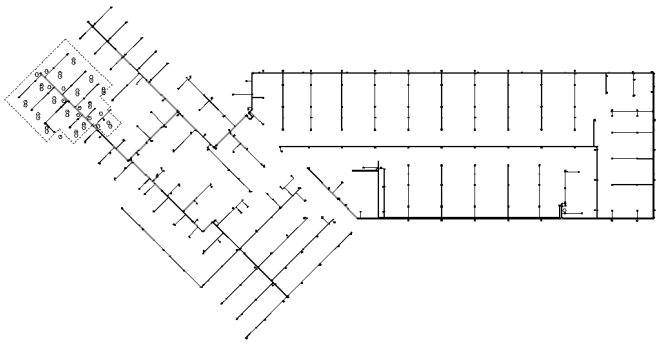
Supplies

Node	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
1	1605.00	250.00	120.000	110.000

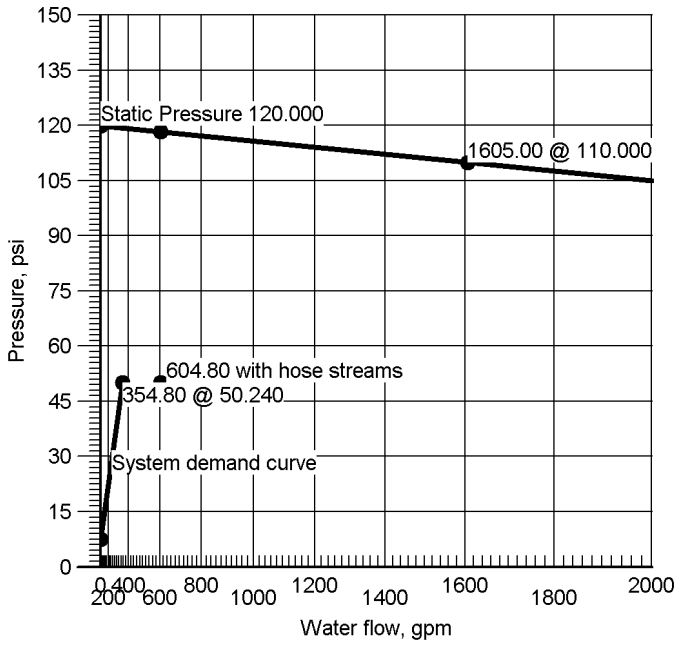
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

Level 1



Supply at Node 1 (1605.00, 250.00, 120.000, 110.000)



Hydraulic Summary

Job

Job Number: 824	Design Engineer:
Job Name: College of San Mateo Building 5N	State Certification/License Number:
Address 1:	AHJ:
Address 2:	Job Site: Building 5N
City: San Mateo / State: CA / Zip Code:	Drawing Name: Level 1

System

Most Demanding Sprinkler Data: 5.6 K-Factor 19.50 at 12.125

Hose Allowance At Source: 250.00

Additional Hose Supplies

Node	Flow(gpm)

Total Hose Streams: 250.00

System Flow Demand: 354.80

Total Water Required (Including Hose Allowance): 604.80

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 8.71 between nodes 303 and 302

Maximum Velocity Under Ground: 3.91 between nodes 4 and 5

Volume capacity of Wet Pipes: 2507.82gal

Volume capacity of Dry Pipes:

Remote Area(s)

Occupancy: Ordinary Group I

Density: 0.150gpm/ft²

Area of Application: 1500.00ft² (Actual 1530.11ft²)

Number Of Sprinklers Calculated: 17

Coverage Per Sprinkler: 130.00ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Supplies

Node	Hose Flow (gpm)	Static (psi)	Residual (psi)	@ Flow (gpm)	Available (psi)	@ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	250.00	120.000	110.000	1605.00	118.356	604.80	50.240	68.116

Contractor

Contractor Number: 1		Contact Name: Randy Ralston	Contact Title: PM
Contractor Name: Transbay Fire Protection, Inc.		Phone: 925-846-9484	Extension: 23
Address 1: 2182 Rheem Drive		FAX: 925-846-9710	
Address 2:		E-mail: randy@transbayfire.com	
City: Pleasanton	State: CA / Zip Code: 94588	Web-Site:	

Summary Of Outflowing Devices

Job Number: 824
Report Description: 1st Floor Mechanical Area

Device	Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Sprinkler 104	20.91	19.50	5.6	13.942		
Sprinkler 110	21.00	19.50	5.6	14.065		
Sprinkler 106	20.92	19.50	5.6	13.953		
Sprinkler 112	21.06	19.50	5.6	14.139		
Sprinkler 109	20.98	19.50	5.6	14.032		
Sprinkler 111	21.01	19.50	5.6	14.077		
Sprinkler 113	21.07	19.50	5.6	14.152		
Sprinkler 107	20.95	19.50	5.6	13.992		
Sprinkler 114	21.07	19.50	5.6	14.156		
Sprinkler 103	20.61	19.50	5.6	13.544		
Sprinkler 105	20.92	19.50	5.6	13.950		
Sprinkler 108	20.96	19.50	5.6	14.004		
Sprinkler 117	21.24	19.50	5.6	14.389		
Sprinkler 116	21.19	19.50	5.6	14.324		
Sprinkler 102	20.24	19.50	5.6	13.061		
Sprinkler 115	21.19	19.50	5.6	14.317		
⇨ Sprinkler 101	19.50	19.50	5.6	12.125		

⇨ Most Demanding Sprinkler Data

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
308	11'-6	PO(5'-0)	15.498		
309	11'-6	PO(5'-0)	15.629		
313	11'-6	PO(5'-0)	15.511		
317	11'-6	PO(9'-10¾)	16.437		
310	11'-6	PO(9'-10¾)	16.438		
316	11'-6	PO(5'-0)	15.708		
320	11'-6	PO(5'-0)	15.594		
314	11'-6	PO(5'-0)	15.642		
311	11'-6	PO(9'-10¾)	16.451		
319	11'-6	PO(5'-0)	15.722		
312	11'-6	PO(9'-10¾)	16.474		
315	11'-6	PO(5'-0)	15.551		
321	11'-6	PO(5'-0)	15.726		
303	11'-6	PO(9'-10¾)	16.501		
302	11'-6	PO(5'-0)	15.076		
304	11'-6	PO(9'-10¾)	16.562		
318	11'-6	PO(5'-0)	15.565		
305	11'-6	PO(9'-10¾)	16.650		
324	11'-6	T(5'-0)	16.396		
306	11'-6	PO(5'-0)	16.700		
323	11'-6	PO(5'-0)	15.973		
301	11'-6	2PO(5'-0)	14.565		
307	11'-6	PO(6'-0)	16.847		
322	11'-6	PO(5'-0)	15.896		
17	46'-2	Hose	100.000		
15	31'-0	PO(26'-4)	0.000		
16	39'-6	Z	0.000		
8	-3'-6		42.784		
12	11'-0	2PO(37'-8¾)	36.343		
9	1'-0		40.687		
10	3'-0	PO(26'-4)	39.812		
13	17'-0	PO(26'-4)	0.000		
11	11'-6	LtE(7'-10¾)	33.631		
14	25'-6	Z	0.000		
6	-3'-6	E(21'-6¾)	43.321		
5	-4'-6	E(24'-2¼)	49.874		
4	-4'-6	T(46'-2½)	50.046		
7	-3'-6	T(46'-2½)	43.236		
3	-3'-6	E(21'-6¾)	0.000		
2	3'-6	FDC	0.000		
104	12'-11¾	Spr(-13.942)	13.942	20.91	
110	12'-11¾	Spr(-14.065)	14.065	21.00	
106	12'-11¾	Spr(-13.953)	13.953	20.92	
112	12'-11¾	Spr(-14.139)	14.139	21.06	
109	12'-11¾	Spr(-14.032)	14.032	20.98	
111	12'-11¾	Spr(-14.077)	14.077	21.01	
113	12'-11¾	Spr(-14.152)	14.152	21.07	
107	12'-11¾	Spr(-13.992)	13.992	20.95	
114	12'-11¾	Spr(-14.156)	14.156	21.07	
103	12'-11¾	Spr(-13.544)	13.544	20.61	
105	12'-11¾	Spr(-13.950)	13.950	20.92	
108	12'-11¾	Spr(-14.004)	14.004	20.96	
117	12'-11¾	Spr(-14.389)	14.389	21.24	
116	13'-0	Spr(-14.324)	14.324	21.19	
102	12'-11¾	Spr(-13.061)	13.061	20.24	
115	12'-11¾	Spr(-14.317)	14.317	21.19	
101	12'-11¾	Spr(-12.125)	12.125	19.50	
1	-4'-6	S	50.240	354.80	

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
SP	1.0490	Q=19.50	7.24	C=120		0.124177	7'-5¾	Pf 1.798
101	12'-11¾	q=19.50	K=5.6	12.125		Spr(-12.125)	7'-0	Pe 0.641
301	11'-6			14.565		E(2'-0), PO(5'-0)	14'-5¾	Pv
BL	1.6820	Q=39.74	5.74	C=120		0.046497	11'-0	Pf 0.511
301	11'-6			14.565				Pe
302	11'-6			15.076			11'-0	Pv
BL	1.6820	Q=60.35	8.71	C=120		0.100717	4'-3	Pf 1.425
302	11'-6			15.076			9'-10¾	Pe
303	11'-6			16.501		PO(9'-10¾)	14'-1¾	Pv
CM	4.2600	Q=228.22	5.14	C=120		0.012775	4'-9	Pf 0.061
303	11'-6			16.501				Pe
304	11'-6			16.562			4'-9	Pv
CM	4.2600	Q=270.26	6.08	C=120		0.017468	5'-0½	Pf 0.088
304	11'-6			16.562				Pe
305	11'-6			16.650			5'-0½	Pv
CM	4.2600	Q=312.69	7.04	C=120		0.022877	2'-2¼	Pf 0.050
305	11'-6			16.650				Pe
306	11'-6			16.700			2'-2¼	Pv
CM	4.2600	Q=333.61	7.51	C=120		0.025788	5'-8¼	Pf 0.147
306	11'-6			16.700				Pe -0.000
307	11'-6			16.847			5'-8¼	Pv
CM	4.2600	Q=354.80	7.99	C=120		0.028901	443'-9¾	Pf 16.784
307	11'-6			16.847			136'-11¼	Pe
11	11'-6			33.631		10LtE(7'-10¾), 2T(26'-4), EE(5'-3¼)	580'-9	Pv
FR	4.2600	Q=354.80	7.99	C=120		0.028901	7'-4½	Pf 2.496
11	11'-6			33.631			79'-0	Pe 3.685
10	3'-0			39.812		Z, CV(28'-11½), BV(15'-9½), LtE(7'-10¾), PO(26'-4)	86'-4½	Pv
ST	6.3570	Q=354.80	3.59	C=120		0.004114	2'-0	Pf 0.008
10	3'-0			39.812				Pe 0.867
9	1'-0			40.687			2'-0	Pv
UG	6.4000	Q=354.80	3.54	C=140		0.002994	24'-6¼	Pf 0.146
9	1'-0			40.687			24'-2¼	Pe 1.951
8	-3'-6			42.784		E(24'-2¼)	48'-8¾	Pv
UG	6.0900	Q=354.80	3.91	C=150		0.003356	91'-7½	Pf 0.452
8	-3'-6			42.784			43'-1¾	Pe
7	-3'-6			43.236		2E(21'-6¾)	134'-9¼	Pv
UG	6.0900	Q=354.80	3.91	C=150		0.003356	3'-8	Pf 0.085
7	-3'-6			43.236			21'-6¾	Pe
6	-3'-6			43.321		E(21'-6¾)	25'-2¾	Pv
UG	6.4000	Q=354.80	3.54	C=140		0.002994	16'-0	Pf 6.120
6	-3'-6			43.321			24'-2¼	Pe 0.434
5	-4'-6			49.874		BFP(-6.000), E(24'-2¼)	40'-2¼	Pv
UG	6.0900	Q=354.80	3.91	C=150		0.003356	5'-0	Pf 0.172
5	-4'-6			49.874			46'-2½	Pe
4	-4'-6			50.046		T(46'-2½)	51'-2¾	Pv
UG	7.9800	Q=354.80	2.28	C=150		0.000900	188'-6¾	Pf 0.194
4	-4'-6			50.046			27'-2	Pe
1	-4'-6			50.240		E(27'-2), S	215'-8¾	Pv
• • • • • Route 2 • • • • •								
SP	1.0490	Q=20.24	7.51	C=120		0.133020	1'-5¾	Pf 0.862
102	12'-11¾	q=20.24	K=5.6	13.061		Spr(-13.061)	5'-0	Pe 0.641
301	11'-6			14.565		PO(5'-0)	6'-5¾	Pv
• • • • • Route 3 • • • • •								
SP	1.0490	Q=20.61	7.65	C=120		0.137555	1'-5¾	Pf 0.891
103	12'-11¾	q=20.61	K=5.6	13.544		Spr(-13.544)	5'-0	Pe 0.641
302	11'-6			15.076		PO(5'-0)	6'-5¾	Pv
• • • • • Route 4 • • • • •								
SP	1.0490	Q=20.91	7.76	C=120		0.141291	1'-5¾	Pf 0.915
104	12'-11¾	q=20.91	K=5.6	13.942		Spr(-13.942)	5'-0	Pe 0.641
308	11'-6			15.498		PO(5'-0)	6'-5¾	Pv
BL	1.6820	Q=20.91	3.02	C=120		0.014175	9'-3	Pf 0.131
308	11'-6			15.498				Pe
309	11'-6			15.629			9'-3	Pv
BL	1.6820	Q=41.91	6.05	C=120		0.051310	5'-10¼	Pf 0.808
309	11'-6			15.629			9'-10¾	Pe -0.000
310	11'-6			16.438		PO(9'-10¾)	15'-9	Pv
CM	4.2600	Q=83.92	1.89	C=120		0.002007	6'-7¾	Pf 0.013
310	11'-6			16.438				Pe 0.000
311	11'-6			16.451			6'-7¾	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
CM	4.2600	Q=125.94	2.83	C=120	0.004253	5'-3¼	Pf 0.022
311	11'-6			16.451			Pe
312	11'-6			16.474		5'-3¼	Pv
CM	4.2600	Q=167.87	3.78	C=120	0.007238	3'-9¾	Pf 0.028
312	11'-6			16.474			Pe
303	11'-6			16.501		3'-9¾	Pv
• • • • • Route 5 • • • • •							
SP	1.0490	Q=20.92	7.76	C=120	0.141369	7'-11	Pf 2.109
105	12'-11¾	q=20.92	K=5.6	13.950	Spr(-13.950)	7'-0	Pe 0.641
306	11'-6			16.700	E(2'-0), PO(5'-0)	14'-11	Pv
• • • • • Route 6 • • • • •							
SP	1.0490	Q=20.92	7.77	C=120	0.141402	1'-5¾	Pf 0.916
106	12'-11¾	q=20.92	K=5.6	13.953	Spr(-13.953)	5'-0	Pe 0.641
313	11'-6			15.511	PO(5'-0)	6'-5¾	Pv
BL	1.6820	Q=20.92	3.02	C=120	0.014186	9'-3	Pf 0.131
313	11'-6			15.511			Pe
314	11'-6			15.642		9'-3	Pv
BL	1.6820	Q=41.93	6.05	C=120	0.051350	6'-3½	Pf 0.831
314	11'-6			15.642		9'-10¾	Pe
312	11'-6			16.474	PO(9'-10¾)	16'-2¼	Pv
• • • • • Route 7 • • • • •							
SP	1.0490	Q=20.95	7.78	C=120	0.141759	1'-5¾	Pf 0.918
107	12'-11¾	q=20.95	K=5.6	13.992	Spr(-13.992)	5'-0	Pe 0.641
315	11'-6			15.551	PO(5'-0)	6'-5¾	Pv
BL	1.6820	Q=20.95	3.02	C=120	0.014222	11'-0	Pf 0.156
315	11'-6			15.551			Pe
316	11'-6			15.708		11'-0	Pv
BL	1.6820	Q=42.00	6.06	C=120	0.051519	4'-3	Pf 0.729
316	11'-6			15.708		9'-10¾	Pe
317	11'-6			16.437	PO(9'-10¾)	14'-1¾	Pv
CM	4.2600	Q=42.00	0.95	C=120	0.000558	1'-11¼	Pf 0.001
317	11'-6			16.437			Pe -0.000
310	11'-6			16.438		1'-11¼	Pv
• • • • • Route 8 • • • • •							
SP	1.0490	Q=20.96	7.78	C=120	0.141880	1'-5¾	Pf 0.919
108	12'-11¾	q=20.96	K=5.6	14.004	Spr(-14.004)	5'-0	Pe 0.641
318	11'-6			15.565	PO(5'-0)	6'-5¾	Pv
BL	1.6820	Q=20.96	3.03	C=120	0.014234	11'-0	Pf 0.157
318	11'-6			15.565			Pe
319	11'-6			15.722		11'-0	Pv
BL	1.6820	Q=42.02	6.07	C=120	0.051563	4'-3	Pf 0.730
319	11'-6			15.722		9'-10¾	Pe
311	11'-6			16.451	PO(9'-10¾)	14'-1¾	Pv
• • • • • Route 9 • • • • •							
SP	1.0490	Q=20.98	7.79	C=120	0.142138	1'-5¾	Pf 0.921
109	12'-11¾	q=20.98	K=5.6	14.032	Spr(-14.032)	5'-0	Pe 0.641
320	11'-6			15.594	PO(5'-0)	6'-5¾	Pv
BL	1.6820	Q=20.98	3.03	C=120	0.014260	9'-3	Pf 0.132
320	11'-6			15.594			Pe
321	11'-6			15.726		9'-3	Pv
BL	1.6820	Q=42.05	6.07	C=120	0.051617	6'-3½	Pf 0.836
321	11'-6			15.726		9'-10¾	Pe
304	11'-6			16.562	PO(9'-10¾)	16'-2¼	Pv
• • • • • Route 10 • • • • •							
SP	1.0490	Q=21.00	7.80	C=120	0.142449	1'-5¾	Pf 0.923
110	12'-11¾	q=21.00	K=5.6	14.065	Spr(-14.065)	5'-0	Pe 0.641
309	11'-6			15.629	PO(5'-0)	6'-5¾	Pv
• • • • • Route 11 • • • • •							
SP	1.0490	Q=21.01	7.80	C=120	0.142561	1'-5¾	Pf 0.924
111	12'-11¾	q=21.01	K=5.6	14.077	Spr(-14.077)	5'-0	Pe 0.641
314	11'-6			15.642	PO(5'-0)	6'-5¾	Pv
• • • • • Route 12 • • • • •							
SP	1.0490	Q=21.06	7.82	C=120	0.143140	1'-5¾	Pf 0.927
112	12'-11¾	q=21.06	K=5.6	14.139	Spr(-14.139)	5'-0	Pe 0.641
316	11'-6			15.708	PO(5'-0)	6'-5¾	Pv
• • • • • Route 13 • • • • •							
SP	1.0490	Q=21.07	7.82	C=120	0.143262	1'-5¾	Pf 0.928
113	12'-11¾	q=21.07	K=5.6	14.152	Spr(-14.152)	5'-0	Pe 0.641
319	11'-6			15.722	PO(5'-0)	6'-5¾	Pv
• • • • • Route 14 • • • • •							
SP	1.0490	Q=21.07	7.82	C=120	0.143302	1'-5¾	Pf 0.928
114	12'-11¾	q=21.07	K=5.6	14.156	Spr(-14.156)	5'-0	Pe 0.641
321	11'-6			15.726	PO(5'-0)	6'-5¾	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 15 • • • • •								
SP	1.0490	Q=21.19	7.87	C=120		0.144806	1'-5¾	Pf 0.938
115	12'-11¾	q=21.19	K=5.6	14.317		Spr(-14.317)	5'-0	Pe 0.641
322	11'-6			15.896		PO(5'-0)	6'-5¾	Pv
BL	1.6820	Q=21.19	3.06	C=120		0.014528	5'-3	Pf 0.076
322	11'-6			15.896				Pe
323	11'-6			15.973			5'-3	Pv
BL	1.6820	Q=42.43	6.13	C=120		0.052493	3'-0	Pf 0.677
323	11'-6			15.973			9'-10¾	Pe
305	11'-6			16.650		PO(9'-10¾)	12'-10¾	Pv
• • • • • Route 16 • • • • •								
AO	1.0490	Q=21.19	7.87	C=120		0.144871	2'-9¾	Pf 1.422
116	13'-0	q=21.19	K=5.6	14.324		Spr(-14.324)	7'-0	Pe 0.650
324	11'-6			16.396		E(2'-0), T(5'-0)	9'-9¾	Pv
AO	1.3800	Q=21.19	4.55	C=120		0.038102	5'-10	Pf 0.451
324	11'-6			16.396			6'-0	Pe
307	11'-6			16.847		PO(6'-0)	11'-10	Pv
• • • • • Route 17 • • • • •								
SP	1.0490	Q=21.24	7.89	C=120		0.145479	1'-5¾	Pf 0.943
117	12'-11¾	q=21.24	K=5.6	14.389		Spr(-14.389)	5'-0	Pe 0.641
323	11'-6			15.973		PO(5'-0)	6'-5¾	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

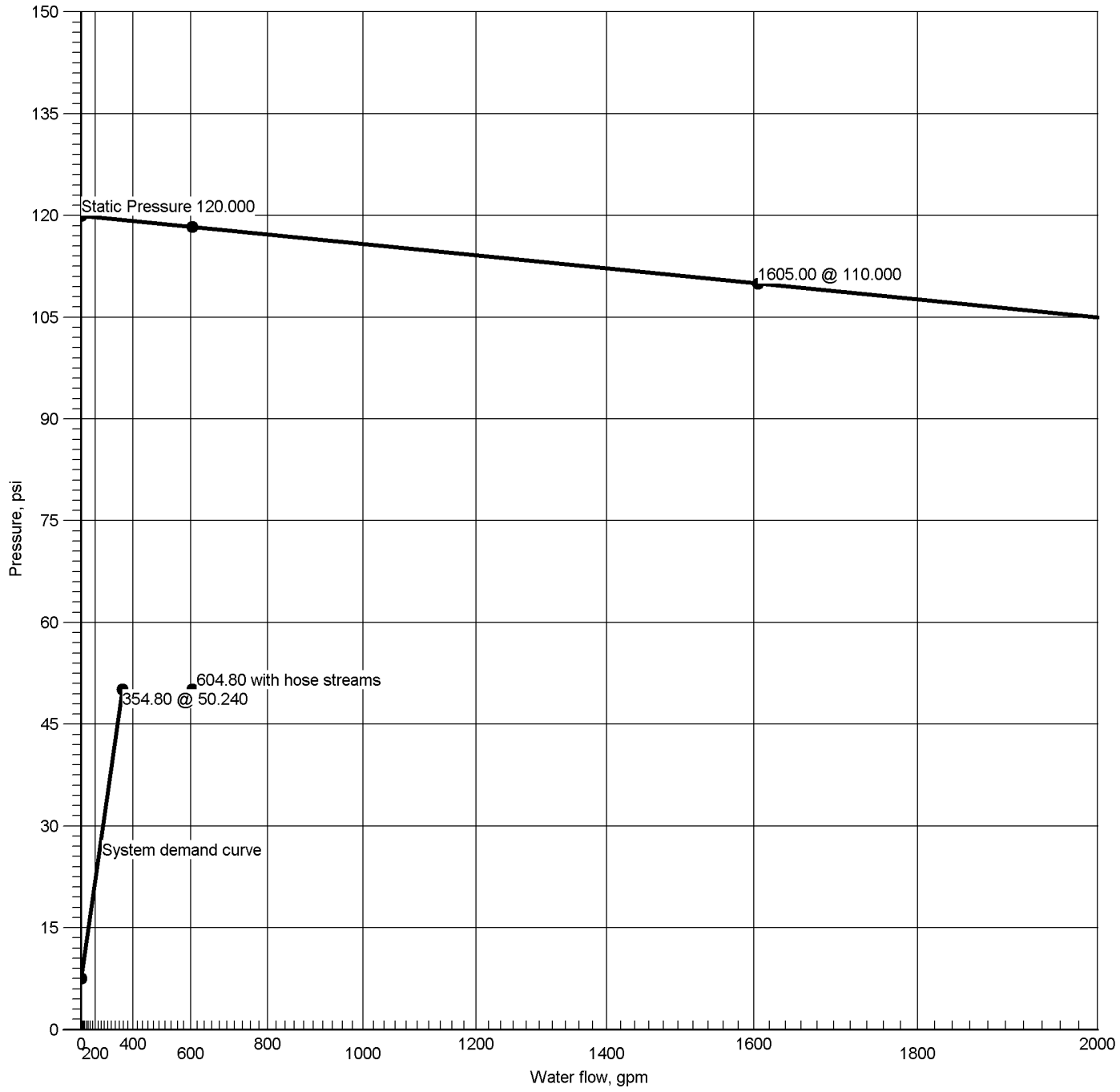
Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PrV	Pressure Relief Valve
PRV	Pressure Reducing Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Supply at Node 1



Hydraulic Graph
Supply at Node 1

Static Pressure
120.000

Residual Pressure
1605.00 @ 110.000

Available PressureTime of Test
118.356 @ 604.80

System Demand
354.80 @ 50.240

System Demand (Including Hose Allowance)
604.80 @ 50.240

Hydraulic Overview

Job

Job Number: 824	Design Engineer:
Job Name: College of San Mateo Building 5N	Phone: / FAX:
Address 1:	State Certification/License Number:
Address 2:	AHJ:
City: San Mateo / State: CA / Zip Code:	Job Site: Building 5N

System

Density: 0.100gpm/ft²	Area of Application: 1500.00ft² (Actual 1630.53ft²)
Most Demanding Sprinkler Data: 11.2 K-Factor 29.63 at 7.000	Hose Streams: 250.00
Coverage Per Sprinkler: 225.00ft²	Number Of Sprinklers Calculated: 9
System Pressure Demand: 53.390	System Flow Demand: 279.38
Total Demand: 529.38 @ 53.390	Pressure Result: +65.325 (55.0%)

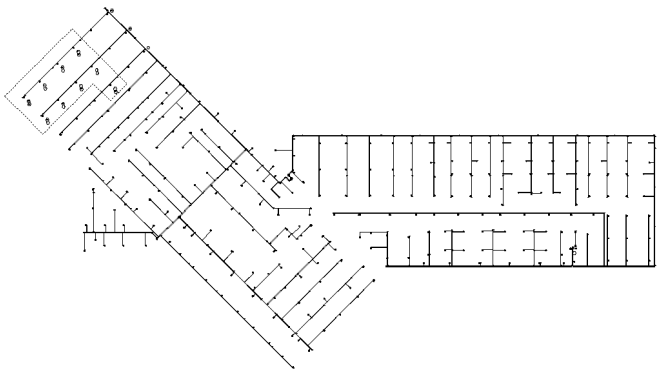
Supplies

Node	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
1	1605.00	250.00	120.000	110.000

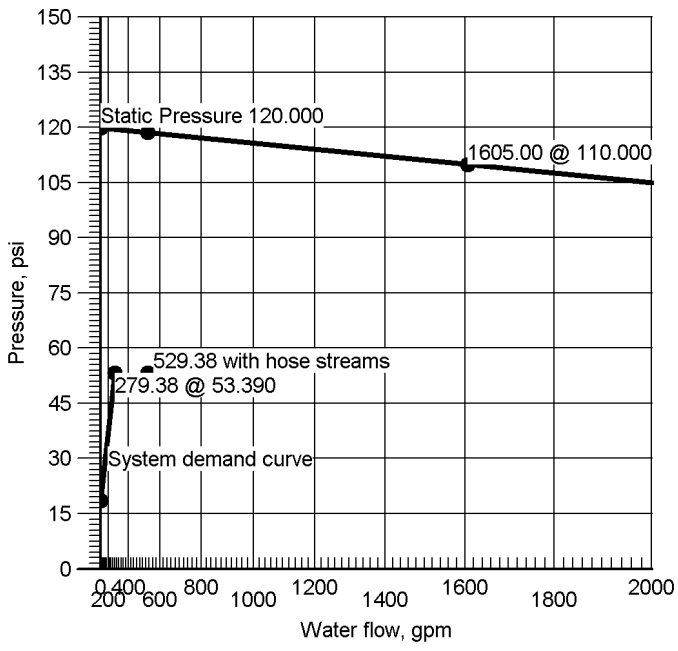
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

Level 3



Supply at Node 1 (1605.00, 250.00, 120.000, 110.000)



Hydraulic Summary

Job

Job Number: 824	Design Engineer:
Job Name: College of San Mateo Building 5N	State Certification/License Number:
Address 1:	AHJ:
Address 2:	Job Site: Building 5N
City: San Mateo, State: CA, Zip Code:	Drawing Name: Level 3

System

Most Demanding Sprinkler Data: 11.2 K-Factor 29.63 at 7.000

Hose Allowance At Source: 250.00

Additional Hose Supplies

Node	Flow(gpm)

Total Hose Streams: 250.00

System Flow Demand: 279.38

Total Water Required (Including Hose Allowance): 529.38

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 13.65 between nodes 312 and 109

Maximum Velocity Under Ground: 3.08 between nodes 4 and 5

Volume capacity of Wet Pipes: 2537.93gal

Volume capacity of Dry Pipes:

Remote Area(s)

Occupancy: Light Hazard

Density: 0.100gpm/ft²

Area of Application: 1500.00ft² (Actual 1630.53ft²)

Number Of Sprinklers Calculated: 9

Coverage Per Sprinkler: 225.00ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Supplies

Node	Hose Flow (gpm)	Static (psi)	Residual (psi)	@ Flow (gpm)	Available (psi)	@ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	250.00	120.000	110.000	1605.00	118.715	529.38	53.390	65.325

Contractor

Contractor Number: 1		Contact Name: Randy Ralston	Contact Title: PM
Contractor Name: Transbay Fire Protection, Inc.		Phone: 925-846-9484	Extension: 23
Address 1: 2182 Rheem Drive		FAX: 925-846-9710	
Address 2:		E-mail: randy@transbayfire.com	
City: Pleasanton	State: CA, Zip Code: 94588	Web-Site:	

Summary Of Outflowing Devices

Job Number: 824
Report Description: 3rd Floor West

Device	Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Sprinkler 107	31.44	26.00	11.2	7.878		
Sprinkler 105	30.36	26.00	11.2	7.347		
Sprinkler 108	31.49	26.00	11.2	7.907		
Sprinkler 103	29.78	26.00	11.2	7.068		
Sprinkler 106	30.41	26.00	11.2	7.374		
Sprinkler 109	36.76	26.00	11.2	10.771		
⇨ Sprinkler 101	29.63	26.00	11.2	7.000		
Sprinkler 104	29.83	26.00	11.2	7.094		
Sprinkler 102	29.69	26.00	11.2	7.026		

⇨ Most Demanding Sprinkler Data

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
305	11'-6	PO(12'-3¾)	15.235		
306	11'-6	PO(12'-3¾)	15.290		
304	11'-6	PO(5'-0)	10.952		
307	11'-6	PO(12'-3¾)	15.490		
303	11'-6	PO(5'-0)	10.201		
311	11'-6	PO(5'-0)	10.992		
302	11'-6	PO(5'-0)	9.808		
310	11'-6	PO(5'-0)	10.240		
312	11'-6	PO(5'-0)	15.019		
301	11'-6	PO(5'-0)	9.711		
309	11'-6	PO(5'-0)	9.845		
308	11'-6	PO(5'-0)	9.748		
17	18'-2	Hose	100.000		
15	3'-0	PO(26'-4)	31.101		
16	11'-6	LtE(7'-10¾)	25.812		
8	-31'-6		46.299		
9	-27'-0		44.254		
10	-25'-0	PO(26'-4)	43.382		
12	-17'-0	PO(26'-4)	39.893		
13	-11'-0	PO(26'-4)	37.276		
11	-16'-6	Z	0.000		
14	-2'-6	Z	0.000		
6	-31'-6	E(21'-6¾)	46.644		
5	-32'-6	E(24'-2¼)	53.155		
4	-32'-6	T(46'-2½)	53.265		
7	-31'-6	T(46'-2½)	46.590		
3	-31'-6	E(21'-6¾)	0.000		
2	-24'-6	FDC	0.000		
107	10'-6¼	Spr(-7.878)	7.878	31.44	
105	10'-6¼	Spr(-7.347)	7.347	30.36	
108	10'-6¼	Spr(-7.907)	7.907	31.49	
103	10'-6¼	Spr(-7.068)	7.068	29.78	
106	10'-6¼	Spr(-7.374)	7.374	30.41	
109	10'-6¼	Spr(-10.771)	10.771	36.76	
101	10'-6¼	Spr(-7.000)	7.000	29.63	
104	10'-6¼	Spr(-7.094)	7.094	29.83	
102	10'-6¼	Spr(-7.026)	7.026	29.69	
1	-32'-6	S	53.390	279.38	

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •								
DR	1.0490	Q=29.63	11.00	C=120		0.269306	2'-7¾	Pf 3.137
101	10'-6¼	q=29.63	K=11.2	7.000		Spr(-7.000)	9'-0	Pe -0.426
301	11'-6			9.711		2E(2'-0), PO(5'-0)	11'-7¾	Pv
BL	2.1570	Q=29.63	2.60	C=120		0.008046	12'-0	Pf 0.097
301	11'-6			9.711				Pe
302	11'-6			9.808			12'-0	Pv
BL	2.1570	Q=59.41	5.22	C=120		0.029136	13'-6	Pf 0.393
302	11'-6			9.808				Pe
303	11'-6			10.201			13'-6	Pv
BL	2.1570	Q=89.77	7.88	C=120		0.062526	12'-0	Pf 0.750
303	11'-6			10.201				Pe
304	11'-6			10.952			12'-0	Pv
BL	2.1570	Q=121.20	10.64	C=120		0.108967	27'-0	Pf 4.283
304	11'-6			10.952			12'-3¾	Pe
305	11'-6			15.235		PO(12'-3¾)	39'-3¾	Pv
CM	4.2600	Q=121.20	2.73	C=120		0.003962	14'-0	Pf 0.055
305	11'-6			15.235				Pe
306	11'-6			15.290			14'-0	Pv
CM	4.2600	Q=242.63	5.46	C=120		0.014308	14'-0	Pf 0.200
306	11'-6			15.290				Pe
307	11'-6			15.490			14'-0	Pv
CM	4.2600	Q=279.38	6.29	C=120		0.018574	452'-11¾	Pf 10.321
307	11'-6			15.490			102'-8½	Pe
16	11'-6			25.812		9LtE(7'-10¾), EE(5'-3¼), T(26'-4)	555'-8¼	Pv
FR	4.2600	Q=279.38	6.29	C=120		0.018574	7'-4½	Pf 1.604
16	11'-6			25.812			79'-0	Pe 3.685
15	3'-0			31.101		Z, CV(28'-11½), BV(15'-9½), LtE(7'-10¾), PO(26'-4)	86'-4½	Pv
ST	6.3570	Q=279.38	2.82	C=120		0.002644	17'-3	Pf 0.105
15	3'-0			31.101			22'-7½	Pe 6.069
13	-11'-0			37.276		2LtE(11'-3¾)	39'-10½	Pv
ST	6.3570	Q=279.38	2.82	C=120		0.002644	6'-0	Pf 0.016
13	-11'-0			37.276				Pe 2.601
12	-17'-0			39.893			6'-0	Pv
ST	6.3570	Q=279.38	2.82	C=120		0.002644	8'-0	Pf 0.021
12	-17'-0			39.893				Pe 3.468
10	-25'-0			43.382			8'-0	Pv
ST	6.3570	Q=279.38	2.82	C=120		0.002644	2'-0	Pf 0.005
10	-25'-0			43.382				Pe 0.867
9	-27'-0			44.254			2'-0	Pv
UG	6.4000	Q=279.38	2.79	C=140		0.001924	24'-6¼	Pf 0.094
9	-27'-0			44.254			24'-2¼	Pe 1.951
8	-31'-6			46.299		E(24'-2¼)	48'-8¾	Pv
UG	6.0900	Q=279.38	3.08	C=150		0.002157	91'-7½	Pf 0.291
8	-31'-6			46.299			43'-1¾	Pe
7	-31'-6			46.590		2E(21'-6¾)	134'-9¼	Pv
UG	6.0900	Q=279.38	3.08	C=150		0.002157	3'-8	Pf 0.054
7	-31'-6			46.590			21'-6¾	Pe
6	-31'-6			46.644		E(21'-6¾)	25'-2¾	Pv
UG	6.4000	Q=279.38	2.79	C=140		0.001924	16'-0	Pf 6.077
6	-31'-6			46.644			24'-2¼	Pe 0.434
5	-32'-6			53.155		BFP(-6.000), E(24'-2¼)	40'-2¼	Pv
UG	6.0900	Q=279.38	3.08	C=150		0.002157	5'-0	Pf 0.110
5	-32'-6			53.155			46'-2½	Pe
4	-32'-6			53.265		T(46'-2½)	51'-2¾	Pv
UG	7.9800	Q=279.38	1.79	C=150		0.000578	188'-6¾	Pf 0.125
4	-32'-6			53.265			27'-2	Pe
1	-32'-6			53.390		E(27'-2), S	215'-8¾	Pv
• • • • • Route 2 • • • • •								
DR	1.0490	Q=29.69	11.02	C=120		0.270227	2'-7¾	Pf 3.148
102	10'-6¼	q=29.69	K=11.2	7.026		Spr(-7.026)	9'-0	Pe -0.426
308	11'-6			9.748		2E(2'-0), PO(5'-0)	11'-7¾	Pv
BL	2.1570	Q=29.69	2.61	C=120		0.008073	12'-0	Pf 0.097
308	11'-6			9.748				Pe
309	11'-6			9.845			12'-0	Pv
BL	2.1570	Q=59.52	5.23	C=120		0.029236	13'-6	Pf 0.395
309	11'-6			9.845				Pe
310	11'-6			10.240			13'-6	Pv
BL	2.1570	Q=89.93	7.90	C=120		0.062739	12'-0	Pf 0.753
310	11'-6			10.240				Pe
311	11'-6			10.992			12'-0	Pv

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
BL	2.1570	Q=121.43	10.66	C=120	0.109339	27'-0	Pf 4.298
311	11'-6			10.992		12'-3¾	Pe
306	11'-6			15.290	PO(12'-3¾)	39'-3¾	Pv
• • • • • Route 3 • • • • •							
DR	1.0490	Q=29.78	11.05	C=120	0.271734	2'-7¾	Pf 3.165
103	10'-6¼	q=29.78	K=11.2	7.068	Spr(-7.068)	9'-0	Pe -0.426
302	11'-6			9.808	2E(2'-0), PO(5'-0)	11'-7¾	Pv
• • • • • Route 4 • • • • •							
DR	1.0490	Q=29.83	11.07	C=120	0.272663	2'-7¾	Pf 3.176
104	10'-6¼	q=29.83	K=11.2	7.094	Spr(-7.094)	9'-0	Pe -0.426
309	11'-6			9.845	2E(2'-0), PO(5'-0)	11'-7¾	Pv
• • • • • Route 5 • • • • •							
DR	1.0490	Q=30.36	11.27	C=120	0.281614	2'-7¾	Pf 3.280
105	10'-6¼	q=30.36	K=11.2	7.347	Spr(-7.347)	9'-0	Pe -0.426
303	11'-6			10.201	2E(2'-0), PO(5'-0)	11'-7¾	Pv
• • • • • Route 6 • • • • •							
DR	1.0490	Q=30.41	11.29	C=120	0.282575	2'-7¾	Pf 3.292
106	10'-6¼	q=30.41	K=11.2	7.374	Spr(-7.374)	9'-0	Pe -0.426
310	11'-6			10.240	2E(2'-0), PO(5'-0)	11'-7¾	Pv
• • • • • Route 7 • • • • •							
DR	1.0490	Q=31.44	11.67	C=120	0.300407	2'-7¾	Pf 3.499
107	10'-6¼	q=31.44	K=11.2	7.878	Spr(-7.878)	9'-0	Pe -0.426
304	11'-6			10.952	2E(2'-0), PO(5'-0)	11'-7¾	Pv
• • • • • Route 8 • • • • •							
DR	1.0490	Q=31.49	11.69	C=120	0.301428	2'-7¾	Pf 3.511
108	10'-6¼	q=31.49	K=11.2	7.907	Spr(-7.907)	9'-0	Pe -0.426
311	11'-6			10.992	2E(2'-0), PO(5'-0)	11'-7¾	Pv
• • • • • Route 9 • • • • •							
DR	1.0490	Q=36.76	13.65	C=120	0.401217	2'-7¾	Pf 4.674
109	10'-6¼	q=36.76	K=11.2	10.771	Spr(-10.771)	9'-0	Pe -0.426
312	11'-6			15.019	2E(2'-0), PO(5'-0)	11'-7¾	Pv
BL	2.1570	Q=36.76	3.23	C=120	0.011987	27'-0	Pf 0.471
312	11'-6			15.019		12'-3¾	Pe
307	11'-6			15.490	PO(12'-3¾)	39'-3¾	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

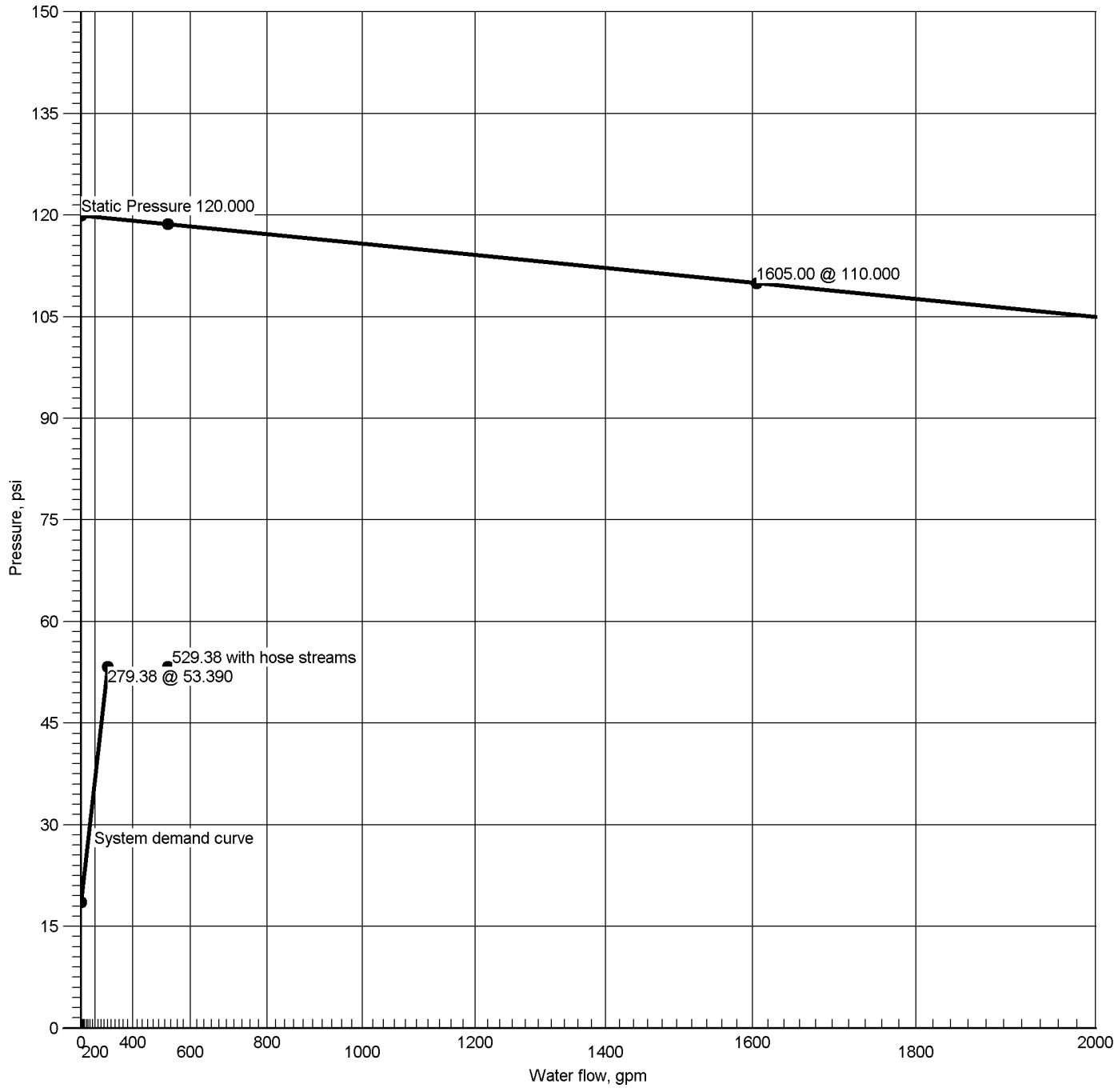
Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PrV	Pressure Relief Valve
PRV	Pressure Reducing Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Supply at Node 1



Hydraulic Graph
Supply at Node 1

Static Pressure
120.000

Residual Pressure
1605.00 @ 110.000

Available PressureTime of Test
118.715 @ 529.38

System Demand
279.38 @ 53.390

System Demand (Including Hose Allowance)
529.38 @ 53.390

Hydraulic Overview

Job

Job Number: 824	Design Engineer:
Job Name: College of San Mateo Building 5N	Phone: / FAX:
Address 1:	State Certification/License Number:
Address 2:	AHJ:
City: San Mateo / State: CA / Zip Code:	Job Site: Building 5N

System

Density: 0.100gpm/ft²	Area of Application: 1500.00ft² (Actual 1526.18ft²)
Most Demanding Sprinkler Data: 11.2 K-Factor 29.63 at 7.000	Hose Streams: 250.00
Coverage Per Sprinkler: 100.00ft²	Number Of Sprinklers Calculated: 11
System Pressure Demand: 54.064	System Flow Demand: 252.20
Total Demand: 502.20 @ 54.064	Pressure Result: +64.770 (54.5%)

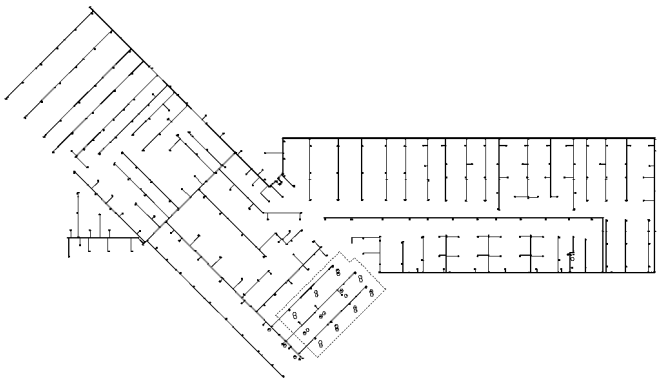
Supplies

Node	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
1	1605.00	250.00	120.000	110.000

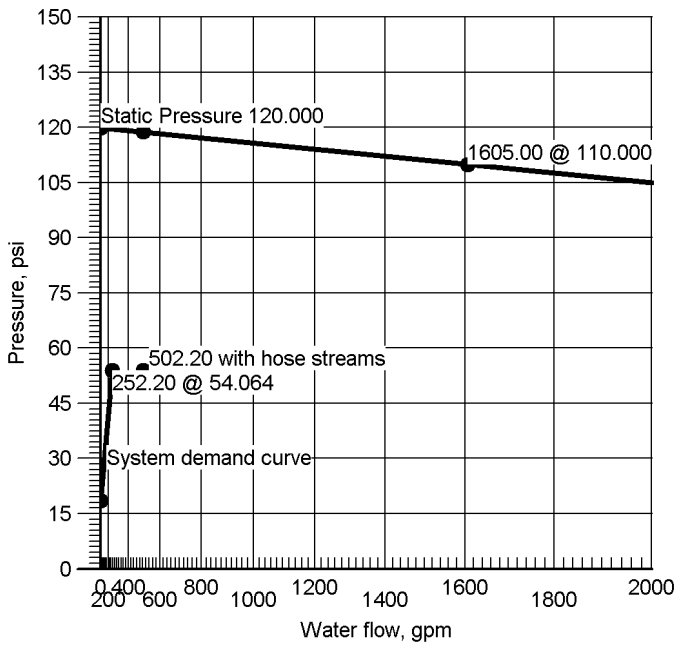
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

Level 3



Supply at Node 1 (1605.00, 250.00, 120.000, 110.000)



Hydraulic Summary

Job

Job Number: 824	Design Engineer:
Job Name: College of San Mateo Building 5N	State Certification/License Number:
Address 1:	AHJ:
Address 2:	Job Site: Building 5N
City: San Mateo / State: CA / Zip Code:	Drawing Name: Level 3

System

Most Demanding Sprinkler Data: 11.2 K-Factor 29.63 at 7.000

Hose Allowance At Source: 250.00

Additional Hose Supplies

Node	Flow(gpm)

Total Hose Streams: 250.00

System Flow Demand: 252.20

Total Water Required (Including Hose Allowance): 502.20

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 13.40 between nodes 317 and 320

Maximum Velocity Under Ground: 2.78 between nodes 4 and 5

Volume capacity of Wet Pipes: 2537.93gal

Volume capacity of Dry Pipes:

Remote Area(s)

Occupancy: Light Hazard

Density: 0.100gpm/ft²

Area of Application: 1500.00ft² (Actual 1526.18ft²)

Number Of Sprinklers Calculated: 11

Coverage Per Sprinkler: 100.00ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Left: 54.064 Right: 54.064

Supplies

Node	Hose Flow (gpm)	Static (psi)	Residual (psi)	@	Flow (gpm)	Available (psi)	@	Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	250.00	120.000	110.000		1605.00	118.835		502.20	54.064	64.770

Contractor

Contractor Number: 1		Contact Name: Randy Ralston	Contact Title: PM
Contractor Name: Transbay Fire Protection, Inc.		Phone: 925-846-9484	Extension: 23
Address 1: 2182 Rheem Drive		FAX: 925-846-9710	
Address 2:		E-mail: randy@transbayfire.com	
City: Pleasanton	State: CA / Zip Code: 94588	Web-Site:	

Summary Of Outflowing Devices

Job Number: 824
Report Description: 3rd Floor East

Device	Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Sprinkler 202	29.77	26.00	11.2	7.066		
Sprinkler 205	17.52	10.00	5.6	9.788		
Sprinkler 207	18.37	10.00	5.6	10.762		
Sprinkler 203	30.40	26.00	11.2	7.367		
⇨ Sprinkler 201	29.63	26.00	11.2	7.000		
Sprinkler 208	18.47	10.00	5.6	10.882		
Sprinkler 206	17.92	10.00	5.6	10.240		
Sprinkler 204	32.61	26.00	11.2	8.477		
Sprinkler 210	18.97	10.00	5.6	11.472		
Sprinkler 209	18.89	10.00	5.6	11.373		
Sprinkler 211	19.65	10.00	5.6	12.313		

⇨ Most Demanding Sprinkler Data

Node Analysis

Job Number: 824
Report Description: 3rd Floor East

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
17	18'-2	Hose	100.000		
15	3'-0	PO(26'-4)	31.930		
16	11'-6	LtE(7'-10¾)	26.918		
8	-31'-6		47.087		
9	-27'-0		45.058		
10	-25'-0	PO(26'-4)	44.187		
12	-17'-0	PO(26'-4)	40.701		
13	-11'-0	PO(26'-4)	38.087		
11	-16'-6	Z	0.000		
14	-2'-6	Z	0.000		
318	11'-6	PO(5'-0)	9.631		
321	11'-6	PO(5'-0)	10.214		
322	11'-6	PO(5'-0)	11.627		
319	11'-6	PO(5'-0)	10.067		
313	11'-6	PO(5'-0)	10.346		
323	11'-6	PO(5'-0)	11.761		
314	11'-6	PO(5'-0)	11.234		
320	11'-6	PO(5'-0)	11.670		
324	11'-6	PO(5'-0)	12.307		
315	11'-6	PO(5'-0)	12.624		
317	11'-6	PO(9'-10¾)	16.765		
325	11'-6	PO(5'-0)	13.350		
316	11'-6	PO(9'-10¾)	16.694		
326	11'-6	PO(9'-10¾)	16.679		
6	-31'-6	E(21'-6¾)	47.372		
5	-32'-6	E(24'-2¼)	53.870		
4	-32'-6	T(46'-2½)	53.961		
7	-31'-6	T(46'-2½)	47.327		
3	-31'-6	E(21'-6¾)	0.000		
2	-24'-6	FDC	0.000		
202	9'-6¼	Spr(-7.066)	7.066	29.77	
205	9'-6¼	Spr(-9.788)	9.788	17.52	
207	10'-6¼	Spr(-10.762)	10.762	18.37	
203	9'-6¼	Spr(-7.367)	7.367	30.40	
201	9'-6¼	Spr(-7.000)	7.000	29.63	
208	10'-6¼	Spr(-10.882)	10.882	18.47	
206	10'-6¼	Spr(-10.240)	10.240	17.92	
204	9'-6¼	Spr(-8.477)	8.477	32.61	
210	10'-6¼	Spr(-11.472)	11.472	18.97	
209	10'-6¼	Spr(-11.373)	11.373	18.89	
211	10'-6¼	Spr(-12.313)	12.313	19.65	
1	-32'-6	S	54.064	252.20	

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •							
DR	1.0490	Q=29.63	11.00	C=120	0.269306	6'-7¼	Pf 4.205
201	9'-6¼	q=29.63	K=11.2	7.000	Spr(-7.000)	9'-0	Pe -0.860
313	11'-6			10.346	2E(2'-0), PO(5'-0)	15'-7¼	Pv
BL	1.6820	Q=47.15	6.81	C=120	0.063807	13'-11	Pf 0.889
313	11'-6			10.346			Pe
314	11'-6			11.234		13'-11	Pv
BL	1.6820	Q=65.07	9.40	C=120	0.115789	12'-0	Pf 1.389
314	11'-6			11.234			Pe
315	11'-6			12.624		12'-0	Pv
BL	1.6820	Q=84.04	12.13	C=120	0.185859	12'-0	Pf 4.070
315	11'-6			12.624		9'-10¾	Pe
316	11'-6			16.694	PO(9'-10¾)	21'-10¾	Pv
CM	4.2600	Q=159.42	3.59	C=120	0.006579	10'-9	Pf 0.071
316	11'-6			16.694			Pe
317	11'-6			16.765		10'-9	Pv
CM	4.2600	Q=252.20	5.68	C=120	0.015369	505'-2¾	Pf 10.153
317	11'-6			16.765		155'-4½	Pe
16	11'-6			26.918	3T(26'-4), 9LtE(7'-10¾), EE(5'-3¼)	660'-7¼	Pv
FR	4.2600	Q=252.20	5.68	C=120	0.015369	7'-4½	Pf 1.327
16	11'-6			26.918		79'-0	Pe 3.685
15	3'-0			31.930	Z, CV(28'-11½), BV(15'-9½), LtE(7'-10¾), PO(26'-4)	86'-4½	Pv
ST	6.3570	Q=252.20	2.55	C=120	0.002188	17'-3	Pf 0.087
15	3'-0			31.930		22'-7½	Pe 6.069
13	-11'-0			38.087	2LtE(11'-3¾)	39'-10½	Pv
ST	6.3570	Q=252.20	2.55	C=120	0.002188	6'-0	Pf 0.013
13	-11'-0			38.087			Pe 2.601
12	-17'-0			40.701		6'-0	Pv
ST	6.3570	Q=252.20	2.55	C=120	0.002188	8'-0	Pf 0.018
12	-17'-0			40.701			Pe 3.468
10	-25'-0			44.187		8'-0	Pv
ST	6.3570	Q=252.20	2.55	C=120	0.002188	2'-0	Pf 0.004
10	-25'-0			44.187			Pe 0.867
9	-27'-0			45.058		2'-0	Pv
UG	6.4000	Q=252.20	2.52	C=140	0.001592	24'-6¼	Pf 0.078
9	-27'-0			45.058		24'-2¼	Pe 1.951
8	-31'-6			47.087	E(24'-2¼)	48'-8¾	Pv
UG	6.0900	Q=252.20	2.78	C=150	0.001784	91'-7½	Pf 0.240
8	-31'-6			47.087		43'-1¾	Pe
7	-31'-6			47.327	2E(21'-6¾)	134'-9¼	Pv
UG	6.0900	Q=252.20	2.78	C=150	0.001784	3'-8	Pf 0.045
7	-31'-6			47.327		21'-6¾	Pe
6	-31'-6			47.372	E(21'-6¾)	25'-2¾	Pv
UG	6.4000	Q=252.20	2.52	C=140	0.001592	16'-0	Pf 6.064
6	-31'-6			47.372		24'-2¼	Pe 0.434
5	-32'-6			53.870	BFP(-6.000), E(24'-2¼)	40'-2¼	Pv
UG	6.0900	Q=252.20	2.78	C=150	0.001784	5'-0	Pf 0.091
5	-32'-6			53.870		46'-2½	Pe
4	-32'-6			53.961	T(46'-2½)	51'-2¾	Pv
UG	7.9800	Q=252.20	1.62	C=150	0.000478	188'-6¾	Pf 0.103
4	-32'-6			53.961		27'-2	Pe
1	-32'-6			54.064	E(27'-2), S	215'-8¾	Pv
• • • • • Route 2 • • • • •							
DR	1.0490	Q=29.77	11.05	C=120	0.271654	3'-7¼	Pf 3.425
202	9'-6¼	q=29.77	K=11.2	7.066	Spr(-7.066)	9'-0	Pe -0.860
318	11'-6			9.631	2E(2'-0), PO(5'-0)	12'-7¼	Pv
BL	1.6820	Q=29.77	4.30	C=120	0.027253	16'-0	Pf 0.436
318	11'-6			9.631			Pe
319	11'-6			10.067		16'-0	Pv
BL	1.6820	Q=60.17	8.69	C=120	0.100174	16'-0	Pf 1.603
319	11'-6			10.067			Pe
320	11'-6			11.670		16'-0	Pv
BL	1.6820	Q=92.78	13.40	C=120	0.223189	12'-11	Pf 5.094
320	11'-6			11.670		9'-10¾	Pe
317	11'-6			16.765	PO(9'-10¾)	22'-10	Pv
• • • • • Route 3 • • • • •							
DR	1.0490	Q=30.40	11.29	C=120	0.282349	3'-7¼	Pf 3.560
203	9'-6¼	q=30.40	K=11.2	7.367	Spr(-7.367)	9'-0	Pe -0.860
319	11'-6			10.067	2E(2'-0), PO(5'-0)	12'-7¼	Pv
• • • • • Route 4 • • • • •							

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt	Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
DR	1.0490	Q=32.61	12.11	C=120		0.321472	3'-7¼	Pf 4.053
204	9'-6¼	q=32.61	K=11.2	8.477		Spr(-8.477)	9'-0	Pe -0.860
320	11'-6			11.670		2E(2'-0), PO(5'-0)	12'-7¼	Pv
• • • • • Route 5 • • • • •								
DR	1.0490	Q=17.52	6.50	C=120		0.101864	3'-7¼	Pf 1.284
205	9'-6¼	q=17.52	K=5.6	9.788		Spr(-9.788)	9'-0	Pe -0.858
321	11'-6			10.214		2E(2'-0), PO(5'-0)	12'-7¼	Pv
BL	1.6820	Q=17.52	2.53	C=120		0.010219	12'-10½	Pf 0.132
321	11'-6			10.214				Pe
313	11'-6			10.346			12'-10½	Pv
• • • • • Route 6 • • • • •								
DR	1.0490	Q=17.92	6.65	C=120		0.106209	4'-4¼	Pf 1.418
206	10'-6¼	q=17.92	K=5.6	10.240		Spr(-10.240)	9'-0	Pe -0.424
314	11'-6			11.234		2E(2'-0), PO(5'-0)	13'-4¼	Pv
• • • • • Route 7 • • • • •								
DR	1.0490	Q=18.37	6.82	C=120		0.111201	2'-7¼	Pf 1.290
207	10'-6¼	q=18.37	K=5.6	10.762		Spr(-10.762)	9'-0	Pe -0.424
322	11'-6			11.627		2E(2'-0), PO(5'-0)	11'-7¼	Pv
BL	1.6820	Q=18.37	2.65	C=120		0.011156	12'-0	Pf 0.134
322	11'-6			11.627				Pe
323	11'-6			11.761			12'-0	Pv
BL	1.6820	Q=36.84	5.32	C=120		0.040426	13'-6	Pf 0.546
323	11'-6			11.761				Pe
324	11'-6			12.307			13'-6	Pv
BL	1.6820	Q=55.73	8.05	C=120		0.086924	12'-0	Pf 1.043
324	11'-6			12.307				Pe
325	11'-6			13.350			12'-0	Pv
BL	1.6820	Q=75.38	10.88	C=120		0.151986	12'-0	Pf 3.329
325	11'-6			13.350			9'-10¾	Pe
326	11'-6			16.679		PO(9'-10¾)	21'-10¾	Pv
CM	4.2600	Q=75.38	1.70	C=120		0.001646	9'-3	Pf 0.015
326	11'-6			16.679				Pe
316	11'-6			16.694			9'-3	Pv
• • • • • Route 8 • • • • •								
DR	1.0490	Q=18.47	6.86	C=120		0.112352	2'-7¼	Pf 1.304
208	10'-6¼	q=18.47	K=5.6	10.882		Spr(-10.882)	9'-0	Pe -0.424
323	11'-6			11.761		2E(2'-0), PO(5'-0)	11'-7¼	Pv
• • • • • Route 9 • • • • •								
DR	1.0490	Q=18.89	7.01	C=120		0.117037	2'-7¼	Pf 1.358
209	10'-6¼	q=18.89	K=5.6	11.373		Spr(-11.373)	9'-0	Pe -0.424
324	11'-6			12.307		2E(2'-0), PO(5'-0)	11'-7¼	Pv
• • • • • Route 10 • • • • •								
DR	1.0490	Q=18.97	7.04	C=120		0.117980	4'-4¼	Pf 1.576
210	10'-6¼	q=18.97	K=5.6	11.472		Spr(-11.472)	9'-0	Pe -0.424
315	11'-6			12.624		2E(2'-0), PO(5'-0)	13'-4¼	Pv
• • • • • Route 11 • • • • •								
DR	1.0490	Q=19.65	7.29	C=120		0.125954	2'-7¼	Pf 1.462
211	10'-6¼	q=19.65	K=5.6	12.313		Spr(-12.313)	9'-0	Pe -0.424
325	11'-6			13.350		2E(2'-0), PO(5'-0)	11'-7¼	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

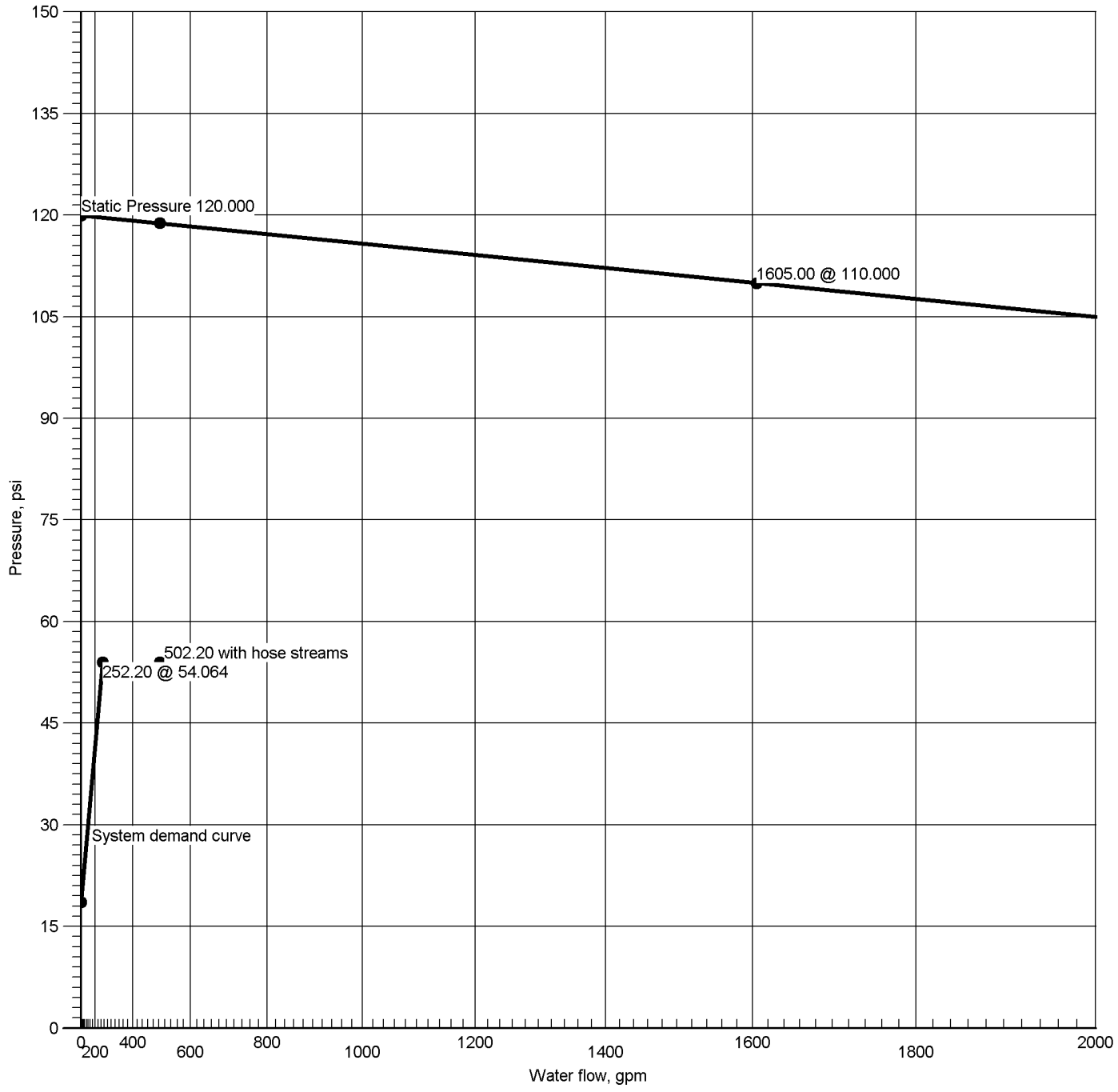
Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PrV	Pressure Relief Valve
PRV	Pressure Reducing Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Supply at Node 1



Hydraulic Graph
Supply at Node 1

Static Pressure
120.000

Residual Pressure
1605.00 @ 110.000

Available PressureTime of Test
118.835 @ 502.20

System Demand
252.20 @ 54.064

System Demand (Including Hose Allowance)
502.20 @ 54.064

Hydraulic Overview

Job

Job Number: 824	Design Engineer:
Job Name: College of San Mateo Building 5N	Phone: / FAX:
Address 1:	State Certification/License Number:
Address 2:	AHJ:
City: San Mateo / State: CA / Zip Code:	Job Site: Building 5N

System

Density: NA	Area of Application: NA
Most Demanding Sprinkler Data: K-Factor at	Hose Streams: 0.00
Coverage Per Sprinkler: NA	Number Of Sprinklers Calculated: 0
System Pressure Demand: 133.271	System Flow Demand: 500.00
Total Demand: 500.00 @ 133.271	Pressure Result: +21.074 (13.7%)

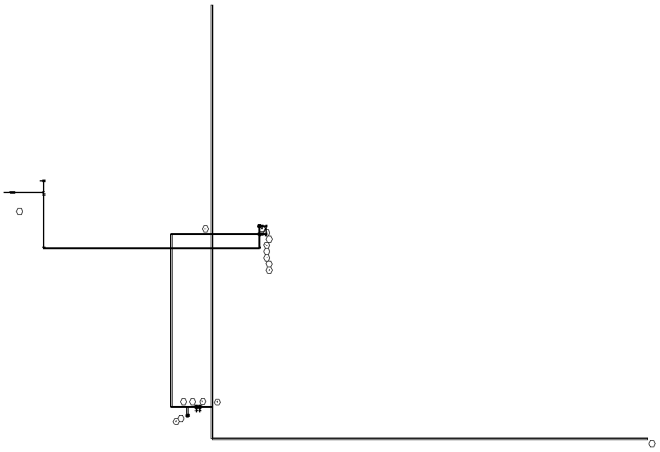
Supplies

Node	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
2	1500.00	0.00	155.000	150.000

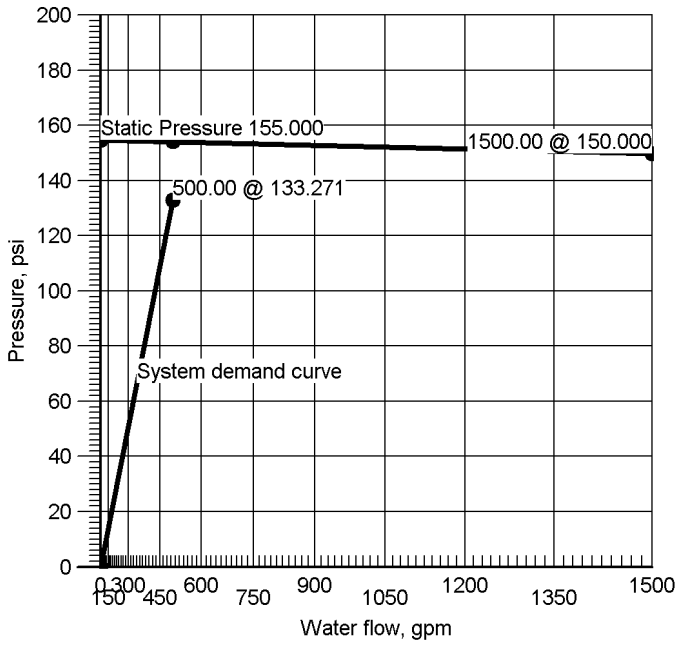
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)

Standpipe Supply



Supply at Node 2 (1500.00, 0.00, 155.000, 150.000)



Hydraulic Summary

Job

Job Number: 824	Design Engineer:
Job Name: College of San Mateo Building 5N	State Certification/License Number:
Address 1:	AHJ:
Address 2:	Job Site: Building 5N
City: San Mateo / State: CA / Zip Code:	Drawing Name: Standpipe Supply

System

Most Demanding Sprinkler Data: K-Factor at

Hose Allowance At Source: 0.00

Additional Hose Supplies

Node	Flow(gpm)
Hose At Node 17	500.00

Total Hose Streams: 500.00

System Flow Demand: 500.00

Total Water Required (Including Hose Allowance): 500.00

Maximum Pressure Unbalance In Loops: 0.000

Maximum Velocity Above Ground: 11.25 between nodes 12 and 17

Maximum Velocity Under Ground: 5.51 between nodes 7 and 8

Volume capacity of Wet Pipes: 1589.99gal

Volume capacity of Dry Pipes:

Remote Area(s)

Occupancy: Manually Calculated

Density: NA

Area of Application: NA

Number Of Sprinklers Calculated: 0

Coverage Per Sprinkler: NA

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Supplies

Node	Hose Flow (gpm)	Static (psi)	Residual (psi)	@ Flow (gpm)	Available (psi)	@ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
2	0.00	155.000	150.000	1500.00	154.345	500.00	133.271	21.074

Contractor

Contractor Number: 1		Contact Name: Randy Ralston	Contact Title: PM
Contractor Name: Transbay Fire Protection, Inc.		Phone: 925-846-9484	Extension: 23
Address 1: 2182 Rheem Drive		FAX: 925-846-9710	
Address 2:		E-mail: randy@transbayfire.com	
City: Pleasanton	State: CA / Zip Code: 94588	Web-Site:	

Summary Of Outflowing Devices

Job Number: 824
Report Description: Standpipe

Device	Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)		
Hose 17	500.00	500.00	50	100.000		

Most Demanding Sprinkler Data

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
15	31'-0	PO(26'-4)	0.000		
16	39'-6	Z	0.000		
8	-3'-6		134.933		
9	1'-0		132.707		
10	3'-0	PO(26'-4)	131.824		
12	11'-0	PO(26'-4)	128.294		
13	17'-0	PO(26'-4)	0.000		
11	11'-6	Z	0.000		
14	25'-6	Z	0.000		
6	-3'-6	E(21'-6¾)	0.000		
5	-4'-6	E(24'-2¼)	0.000		
4	-4'-6	T(46'-2½)	0.000		
7	-3'-6	2T(46'-2½)	136.078		
3	-3'-6	E(21'-6¾)	136.237		
1	-4'-6	Z	0.000		
17	46'-2	Hose(-100.000)	100.000	500.00	
2	3'-6	S, FDC	133.271	500.00	

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
• • • • • Route 1 • • • • •							
ST	4.2600	Q=500.00	11.25	C=120	0.054516	162'-11¾	Pf 13.048
17	46'-2	q=500.00		100.000	Hose(-100.000)	76'-4½	Pe 15.246
12	11'-0			128.294	3LtE(7'-10¾), T(26'-4), PO(26'-4)	239'-4¼	Pv
ST	6.3570	Q=500.00	5.05	C=120	0.007761	8'-0	Pf 0.062
12	11'-0			128.294			Pe 3.468
10	3'-0			131.824		8'-0	Pv
ST	6.3570	Q=500.00	5.05	C=120	0.007761	2'-0	Pf 0.016
10	3'-0			131.824			Pe 0.867
9	1'-0			132.707		2'-0	Pv
UG	6.4000	Q=500.00	4.99	C=140	0.005647	24'-6¼	Pf 0.275
9	1'-0			132.707		24'-2¼	Pe 1.951
8	-3'-6			134.933	E(24'-2¼)	48'-8¾	Pv
UG	6.0900	Q=500.00	5.51	C=150	0.006330	91'-7½	Pf 1.146
8	-3'-6			134.933		89'-4¼	Pe
7	-3'-6			136.078	2E(21'-6¾), T(46'-2½)	180'-11¾	Pv
UG	6.0900	Q=500.00	5.51	C=150	0.006330	3'-6	Pf 0.159
7	-3'-6			136.078		21'-6¾	Pe
3	-3'-6			136.237	E(21'-6¾)	25'-0¾	Pv
OR	6.0650	Q=500.00	5.55	C=120	0.009758	7'-0	Pf 0.068
3	-3'-6			136.237			Pe -3.035
2	3'-6			133.271	S, FDC	7'-0	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

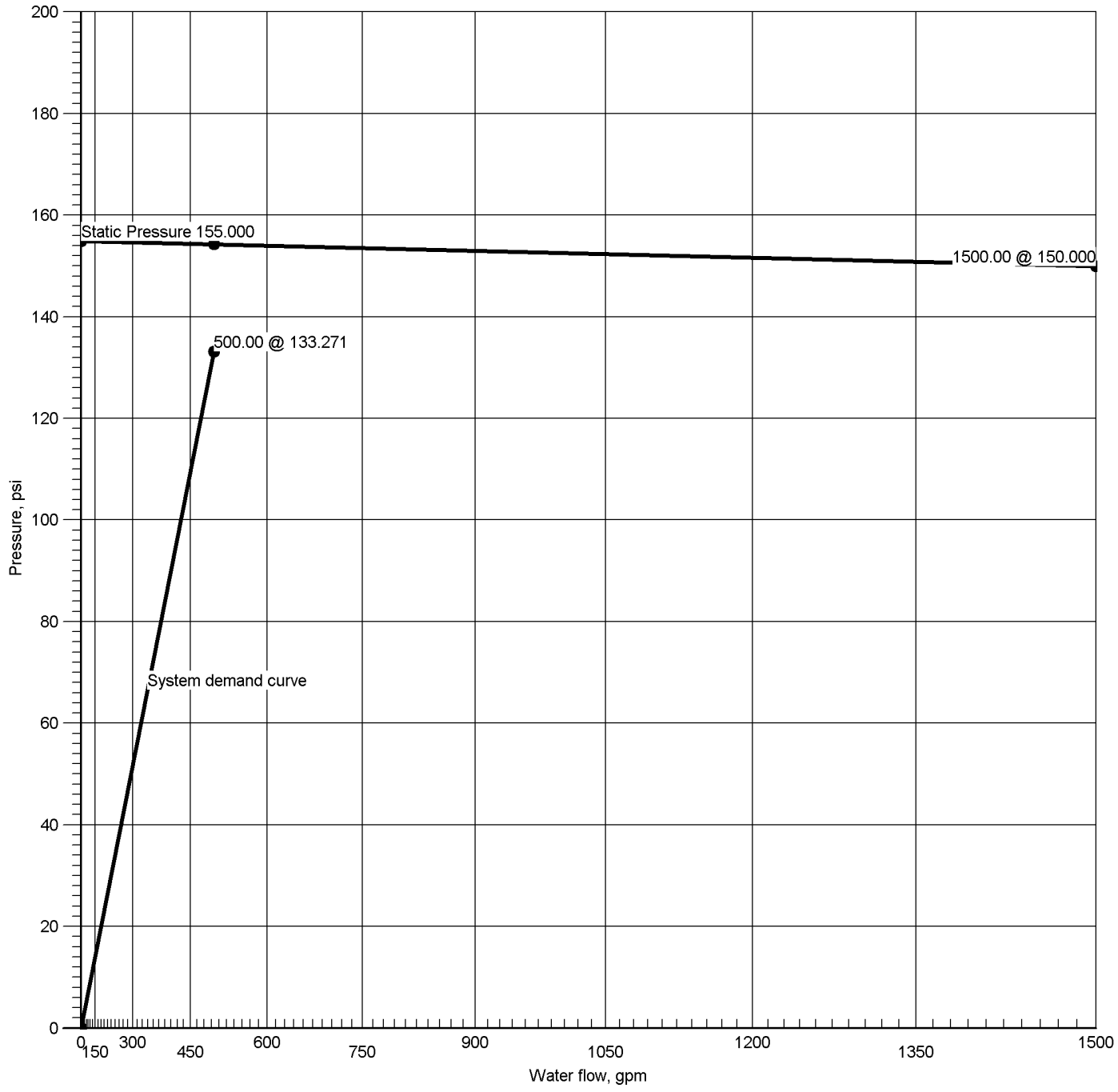
Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PrV	Pressure Relief Valve
PRV	Pressure Reducing Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Supply at Node 2



Hydraulic Graph
Supply at Node 2

Static Pressure
155.000

Residual Pressure
1500.00 @ 150.000

Available PressureTime of Test
154.345 @ 500.00

System Demand
500.00 @ 133.271

Hydrant Numbers
Fire Department Pumper Truck

System Demand (Including Hose Allowance)
500.00 @ 133.271

TRANSBAY FIRE PROTECTION
SEISMIC LOADING CALCULATIONS

PROJECT: College of San Mateo Building 5N

☑ LATERAL BRACE ☐ LONGITUDINAL BRACE BRACE IDENTIFICATION B

LOCATION ON DRAWINGS FP-2.3 Gridline G-J, 3

SWAY BRACE LOADS PER NFPA 13 (2002) SECTION 9.3.5.8

PIPE:	LENGTH	ANGLE	LEAST RADIUS OF GYRATION	MAXIMUM LOAD
☑ 1" SCHEDULE 40	7'-0"	45	0.42	2500 LBS
☐ 1-1/4" SCHEDULE 40	7'-0"	45	0.42	3385 LBS

FITTINGS

	MAXIMUM LOAD		MAXIMUM LOAD
☑ TOLCO FIGURE 4A	2015 LBS	☐ TOLCO FIGURE 980	2765 LBS
☑ TOLCO FIGURE 909	2015 LBS	☐ TOLCO FIGURE 1001	2015 LBS

FASTENER ATTACHMENT PER NFPA 13 (2002) SECTION 9.3.5.9

CONCRETE:	EMBEDMENT	ORIENTATION	MAXIMUM LOAD
☐ 1/2" EXPANSION ANCHOR	3-1/2"	B	1782 LBS
☐ TOLCO FIGURE 309	INSERT	B	1140 LBS
☐ SIMPSON BBWF2550	INSERT	B	1930 LBS

STEEL:	MAXIMUM LOAD PARALLEL	MAXIMUM LOAD PERPENDICULAR
☑ TOLCO FIGURE 800	1265 LBS	2015 LBS
☐ TOLCO FIGURE 825	2015 LBS	2015 LBS
☐ THROUGH BOLT	2050 LBS	2050 LBS

WOOD:	ORIENTATION	MAXIMUM LOAD
☐ 4" LAG BOLT OR LAG SCREW	E	509 LBS
☐ 3" THROUGH BOLT	A,B,C,E	630 LBS
☐ COMPOSITE WOOD JOIST	N/A	620 LBS

SPRINKLER SYSTEM LOADS

SCHEDULE 10 PIPE

SIZE	LENGTH	1/2 WEIGHT OF WATER FILLED PIPE	TOTAL WEIGHT LBS
1		0.91	0.00
1-1/4		1.26	0.00
1-1/2		1.52	0.00
2	268	2.11	565.48
2-1/2		2.95	0.00
3		3.97	0.00
4	40	5.89	235.60
6		11.52	0.00
8		20.04	0.00
		SUBTOTAL	801.08

SCHEDULE 40 PIPE

SIZE	LENGTH	1/2 WEIGHT OF WATER FILLED PIPE	TOTAL WEIGHT LBS
1	87	1.03	89.61
1-1/4		1.47	0.00
1-1/2		1.81	0.00
2		2.57	0.00
2-1/2		3.95	0.00
3		5.41	0.00
4		8.20	0.00
6		15.85	0.00
8		23.85	0.00
		SUBTOTAL	89.61

TOTAL 1/2 WEIGHT OF WATER FILLED PIPE	890.69
WEIGHT OF FITTINGS - ADD 15%	133.60
TOTAL LOAD WEIGHT	**1024.29**

TRANSBAY FIRE PROTECTION
SEISMIC LOADING CALCULATIONS

PROJECT: College of San Mateo Building 5N

☐ LATERAL BRACE ☑ LONGITUDINAL BRACE BRACE IDENTIFICATION A

LOCATION ON DRAWINGS FP-2.4 Gridline N-R, 9

SWAY BRACE LOADS PER NFPA 13 (2002) SECTION 9.3.5.8

PIPE:	LENGTH	ANGLE	LEAST RADIUS OF GYRATION	MAXIMUM LOAD
☑ 1" SCHEDULE 40	7'-0"	45	0.42	2500 LBS
☐ 1-1/4" SCHEDULE 40	7'-0"	45	0.42	3385 LBS

FITTINGS

	MAXIMUM LOAD		MAXIMUM LOAD
☑ TOLCO FIGURE 4A	2015 LBS	☐ TOLCO FIGURE 980	2765 LBS
☑ TOLCO FIGURE 909	2015 LBS	☐ TOLCO FIGURE 1001	2015 LBS

FASTENER ATTACHMENT PER NFPA 13 (2002) SECTION 9.3.5.9

CONCRETE:	EMBEDMENT	ORIENTATION	MAXIMUM LOAD
☐ 1/2" EXPANSION ANCHOR	3-1/2"	B	1782 LBS
☐ TOLCO FIGURE 309	INSERT	B	1140 LBS
☐ SIMPSON BBWF2550	INSERT	B	1930 LBS

STEEL:	MAXIMUM LOAD PARALLEL	MAXIMUM LOAD PERPENDICULAR
☑ TOLCO FIGURE 800	1265 LBS	2015 LBS
☐ TOLCO FIGURE 825	2015 LBS	2015 LBS
☐ THROUGH BOLT	2050 LBS	2050 LBS

WOOD:	ORIENTATION	MAXIMUM LOAD
☐ 4" LAG BOLT OR LAG SCREW	E	509 LBS
☐ 3" THROUGH BOLT	A,B,C,E	630 LBS
☐ COMPOSITE WOOD JOIST	N/A	620 LBS

SPRINKLER SYSTEM LOADS

SCHEDULE 10 PIPE

SIZE	LENGTH	1/2 WEIGHT OF WATER FILLED PIPE	TOTAL WEIGHT LBS
1		0.91	0.00
1-1/4		1.26	0.00
1-1/2		1.52	0.00
2		2.11	0.00
2-1/2		2.95	0.00
3		3.97	0.00
4	80	5.89	471.20
6		11.52	0.00
8		20.04	0.00
		SUBTOTAL	471.20

SCHEDULE 40 PIPE

SIZE	LENGTH	1/2 WEIGHT OF WATER FILLED PIPE	TOTAL WEIGHT LBS
1		1.03	0.00
1-1/4		1.47	0.00
1-1/2		1.81	0.00
2		2.57	0.00
2-1/2		3.95	0.00
3		5.41	0.00
4		8.20	0.00
6		15.85	0.00
8		23.85	0.00
		SUBTOTAL	0.00

TOTAL 1/2 WEIGHT OF WATER FILLED PIPE	471.20
WEIGHT OF FITTINGS - ADD 15%	70.68
TOTAL LOAD WEIGHT	**541.88**

tyco
Fire & Building Products

Tyco Fire Products
451 North Cannon Avenue
Lansdale, PA 19446

Tele: 215 362-0700
Fax: 215 362-5385

TO: Whom It May Concern

DATE: 06/22/06

RE: Tyco Fire & Building Products Brand Names

Per your request, Tyco Fire & Building Products line encompasses the following brands Grinnell, Central, Gem, and Star. Tyco has acquired these companies and their assets.

For any building specification that requires the use of Central, Gem (Grinnell) or Star products, it should be noted that Tyco Fire & Building Products branded products can be substituted as they encompass the same technologies and improved performance as those previously manufactured from the acquired companies. Should you have any questions regarding this information, please do not hesitate to contact me at any time.

Regards,

Carmine Schiavone /db

Carmine Schiavone,
VP Business Development & Communications
Tyco Fire & Building Products
451 North Cannon Avenue
Lansdale, PA 19446
215-362-0700, ext. 267

CS/db

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SECTION I

PIPE & FITTINGS

Schedule-10®/Schedule-40®

Fully Listed and FM Approved Sprinkler Pipe

When you specify Schedule-10/Schedule-40 sprinkler pipe you get a UL listed and FM approved product. Although these products do not require separate approvals, Schedule-10/Schedule-40 gives you the extra quality assurance you demand. Our Sch-10 (1¼"– 8") pipe and Sch-40 (1"– 2½") pipe have passed the same thorough lab testing as our other listed pipe products, and receive periodic mill inspections from both UL and FM agents to ensure consistent quality.

Galvanized Pipe

Schedule-10/Schedule-40 product can be "hot-dip" galvanized to meet FM requirements for dry systems in accordance with the zinc coating specifications of ASTM A-123.

Superior Coating

Our advanced formula mill coating offers a clean, durable surface. It is also paint-ready for custom color applications without special preparation.

The internal surface of all black Allied Tube & Conduit Fire Sprinkler pipe products up to 4.5000" in diameter is coated with our new Antibacterial Formula, "ABF". In scientific laboratory test, ABS proved to have superior resistance to microbial colonization of pipe walls, thereby delaying or possibly preventing the onset of Microbiologically Influenced corrosion (MIC) when the First Sprinkler System is first installed.

American Made

Meets "Buy American" requirement and is available through distributors in the USA, Canada and Mexico.

Specifications & Approvals

Schedule-10/Schedule-40 pipe are in compliance with the following:

ASTM A-135, and NFPA 13. Both pipe products have a working pressure rating of 300 psi maximum and also meet the stringent requirement for the following tests:

- Welded Outlets
- Hydrostatic Pressure
- Side Wall Rupture
- Vibration Test

Sch-40 Specifications

NPS *In; mm*	Nominal I.D. *In; mm*	Wt. *Lbs/Ft; Kg/m*	Wt. (H2O Filled) *Lbs/Ft; Kg/m*	Pcs/ *Lift*	Wt/Lift (21') *Lbs; Kg*	Wt/Lift (24') *Lbs; Kg*	Wt/Lift (25') *Lbs; Kg*
1" *25*	1.049 *26.6*	1.680 *2.5*	2.05 *3.05*	70 *70*	2,470 *1,120*	2,822 *1,280*	2,940 *1,334*
1¼" *32*	1.380 *35.1*	2.270 *4.36*	2.93 *4.36*	51 *51*	2,431 *1,103*	2,778 *1,260*	2,894 *1,313*
1½" *40*	1.610 *40.9*	2.720 *4.0*	3.61 *5.37*	44 *44*	2,513 *1,140*	2,872 *1,303*	2,992 *1,357*
2" *50*	2.067 *52.5*	3.650 *5.4*	5.13 *7.63*	30 *30*	2,300 *1,043*	2,628 *1,192*	2,738 *1,242*
2½" *65*	2.469 *62.7*	5.790 *8.6*	7.86 *11.73*	19 *19*	2,310 *1,048*	2,640 *1,197*	2,750 *1,247*

Sch-10 Specifications

NPS *In; mm*	Nominal I.D. *In; mm*	Wt. *Lbs/Ft; Kg/m*	Wt. (H2O Filled) *Lbs/Ft; Kg/m*	Pcs/ *Lift*	Wt/Lift (21') *Lbs; Kg*	Wt/Lift (24') *Lbs; Kg*	Wt/Lift (25') *Lbs; Kg*
1" *25*	1.097 *27.9*	1.400 *2.1*	1.81 *2.70*	91 *91*	2,675 *1,213*	3,053 *1,385*	3,185 *1,445*
1¼" *32*	1.442 *36.6*	1.810 *2.7*	2.52 *3.75*	61 *61*	2,319 *1,052*	2,664 *1,208*	2,760 *1,252*
1½" *40*	1.682 *42.7*	2.080 *3.1*	3.04 *4.52*	61 *61*	2,664 *1,208*	3,045 *1,381*	3,172 *1,439*
2" *50*	2.157 *54.8*	2.640 *3.9*	4.22 *6.28*	37 *37*	2,051 *930*	2,344 *1,063*	2,442 *1,108*
2½" *65*	2.635 *66.9*	3.530 *5.3*	5.89 *8.77*	30 *30*	2,224 *1,009*	2,542 *1,153*	2,648 *1,201*
3" *80*	3.260 *82.8*	4.330 *6.4*	7.94 *11.82*	19 *19*	1,728 *784*	1,975 *896*	2,057 *933*
4" *90*	4.260 *108.2*	5.610 *8.3*	11.78 *17.53*	19 *19*	2,238 *1,015*	2,558 *1,160*	2,665 *1,209*
5" *125*	5.295 *134.5*	7.77 *11.56*	17.33 *25.80*	10 *10*	1,632 *740*	1,865 *846*	1,943 *881*
6" *150*	6.357 *161.5*	9.290 *13.8*	23.03 *34.27*	10 *10*	1,951 *885*	2,230 *1,012*	2,322 *1,053*
8" *200*	8.249 *209.5*	16.490 *24.5*	40.15 *59.75*	7 *7*	2,424 *1,100*	2,770 *1,256*	2,885 *1,309*

UL Listed FM Approved ULC Listed

tyco / Flow Control

allied TUBE & CONDUIT

16100 S. Lathrop • Harvey, IL 60426
11350 Norcom Rd. • Philadelphia, PA 19154
2525 N. 27 th Ave. • Phoenix, AZ 85009

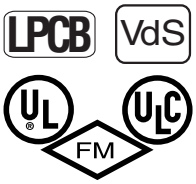
Customer Service:
(800) 882-5543
Fax 708-339-1806

tyco / Fire & Building Products

Technical Services: Tel: (800) 381-9312 / Fax: (800) 791-5500
www.tyco-fire.com

Grinnell Grooved Fire Protection Products
Grooved Fittings

General Description



See Fire Protection Submittal Sheet for Pressure Rating and Listing/Approval Information

The grooved fittings provide an economical and efficient method of changing direction, adding an outlet, reducing, or capping grooved piping systems. Grooved fittings are available in durable ductile iron or fabricated steel as indicated.

Note: Figure 510S and 519S fittings are special short radius fittings with smaller center to end dimensions than standard grooved fittings. Depending on the size and coupling used, there may be interferences at the bolt pads that require repositioning of the coupling orientation. The use of flange adapters is not recommended with Figures 510S and 519S fittings. Contact Tyco Fire Products for details.

WARNING

The Fittings described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. ***Failure to do so may impair the performance of this device.***

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.

Technical Data

Approvals:

UL, FM, ULC, VdS, and LPCB;

Note: See Fire Protection Submittal Sheet for exact Listing / Approval information.

Material:

Cast: Figures: 201, 210, 219, 250, 260, 501, 510, 519, 510DE, 501S, 510S and 519S - Ductile iron conforming to ASTM A-536, Grade 65-45-12

Fabricated Steel: Figures 391, 392, 393, 312, 313, 321, 327, 341 and 350 - Carbon Steel, (Sizes 1¼" - 6" are Schedule 40); (Sizes 8" - 12" are Schedule 30), conforming to ASTM A-53 Grade B

Protective Coatings:

- Non-lead orange paint
- Fire brigade red (optional) non-lead paint
- Hot dipped galvanized conforming to ASTM A-153

Ordering Procedure

When placing an order, indicate the full product name. Please specify the quantity, figure number, wall thickness, and size.

Grinnell Grooved Piping Products, valves, accessories and other products are available throughout the U.S., Canada, and internationally, through a network of distribution centers. You may write directly or call 215-362-0700 for the distributor nearest you.

Care and Maintenance

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in accordance with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any authority having jurisdiction. The installing contractor or product manufacturer should be contacted relative to any questions. Any impairment must be immediately corrected. It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service.

Limited Warranty

Products manufactured by Tyco Fire Products are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by Tyco Fire Products. No warranty is given for products or components manufactured by companies not affiliated by ownership with Tyco Fire Products or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association (NFPA), and/or the standards of any other Authorities Having Jurisdiction. Materials found by Tyco Fire Products to be defective shall be either repaired or replaced, at Tyco Fire Products' sole option. Tyco Fire Products neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. Tyco Fire Products shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

IN NO EVENT SHALL TYCO FIRE PRODUCTS BE LIABLE, IN CONTRACT, TORT, STRICT LIABILITY OR UNDER ANY OTHER LEGAL THEORY, FOR INCIDENTAL, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LABOR CHARGES, REGARDLESS OF WHETHER TYCO FIRE PRODUCTS WAS INFORMED ABOUT THE POSSIBILITY OF SUCH DAMAGES, AND IN NO EVENT SHALL TYCO FIRE PRODUCTS' LIABILITY EXCEED AN AMOUNT EQUAL TO THE SALES PRICE.

THE FOREGOING WARRANTY IS MADE IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Figures 201, 210, 219, and 260

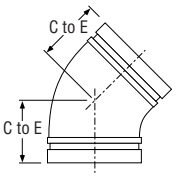


Figure 201

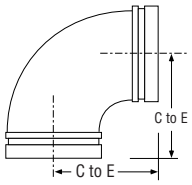


Figure 210

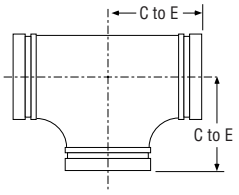


Figure 219

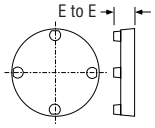


Figure 260

Friction Resistance* (Expressed as Equivalent Straight Pipe)				
Size Inches *mm*	Elbow 90° Feet *Meters*	Elbow 45° Feet *Meters*	Tee Branch Feet *Meters*	Tee Run Feet *Meters*
1¼ *42.4*	1.9 *0.6*	1.0 *0.3*	4.8 *1.5*	1.9 *0.6*
1½ *48.3*	2.3 *0.7*	1.2 *0.4*	5.8 *1.8*	2.3 *0.7*
2 *60.3*	3.2 *1.0*	1.6 *0.5*	8.0 *2.5*	3.2 *1.0*
2½ *73.0*	3.9 *1.2*	2.0 *0.6*	9.8 *3.0*	3.9 *1.2*
76.1mm	4.1 *1.2*	2.1 *0.6*	10.3 *3.1*	4.1 *1.2*
3 *88.9*	4.9 *1.5*	2.4 *0.7*	12.2 *3.7*	4.9 *1.5*
108.0mm	6.5 *2.0*	3.3 *1.0*	16.3 *5.0*	6.5 *2.0*
4 *114.3*	6.5 *2.0*	3.3 *1.0*	16.3 *5.0*	6.5 *2.0*
133.0mm	8.0 *2.4*	4.0 *1.2*	20.0 *6.1*	8.0 *2.4*
139.7mm	8.0 *2.4*	4.1 *1.3*	20.0 *6.1*	8.0 *2.4*
5 *141.3*	8.2 *2.5*	4.1 *1.3*	20.5 *6.3*	8.2 *2.5*
159.0mm	9.5 *2.9*	4.8 *1.4*	23.8 *7.2*	9.5 *2.9*
165.1mm	9.5 *2.9*	4.8 *1.4*	23.8 *7.2*	9.5 *2.9*
6 *168.3*	9.9 *3.0*	5.0 *1.5*	24.8 *7.6*	9.9 *3.0*
216.3mm	13.1 *4.0*	6.6 *2.0*	32.8 *10.0*	13.1 *4.0*
8 *219.1*	13.1 *4.0*	6.6 *2.0*	32.8 *10.0*	13.1 *4.0*
10 *273.0*	16.5 *5.0*	8.3 *2.5*	41.3 *12.6*	16.5 *5.0*
12 *323.4*	19.9 *6.1*	9.9 *3.0*	49.7 *15.1*	19.9 *6.1*

For reducing tees and branches, use the value that is corresponding to the branch size. Example: for 8" x 8" x 2" tee, the branch value 2" is 8.0 feet.

* Friction resistance for all elbows and tees except Figures 510S and 519S.

Nominal Size	Figure 201 45° Elbow C to E Inches *mm*	Figure 201 45° Elbow Appx. Wt. Lbs. *Kg.*	Figure 210 90° Elbow C to E Inches *mm*	Figure 210 90° Elbow Appx. Wt. Lbs. *Kg.*	Figure 219 Tee C to E Inches *mm*	Figure 219 Tee Appx. Wt. Lbs. *Kg.*	Figure 260‡ End Cap E to E Inches *mm*	Figure 260‡ End Cap Appx. Wt. Lbs. *Kg.*
1¼"	1.75 *44.5*	0.9 *0.4*	2.75 *69.9*	1.0 *0.5*	2.75 *69.9*	1.4 *0.6*	0.88 *22.4*	0.4 *0.2*
1½"	1.75 *44.5*	1.1 *0.5*	2.75 *69.9*	1.2 *0.5*	2.75 *69.9*	1.8 *0.8*	0.88 *22.4*	0.6 *0.3*
2"	2.00 *50.8*	1.8 *0.8*	3.25 *82.6*	2.0 *0.9*	3.25 *82.6*	2.7 *1.2*	0.88 *22.4*	0.9 *0.4*
2½"	2.25 *57.2*	2.2 *1.0*	3.75 *95.3*	3.0 *1.4*	3.75 *95.3*	5.8 *2.6*	0.88 *22.4*	0.9 *0.4*
76.1mm	2.25 *57.2*	2.2 *1.0*	3.75 *95.3*	3.0 *1.4*	3.75 *95.3*	5.8 *2.6*	0.94 *23.9*	1.1 *0.5*
3"	2.50 *63.5*	3.5 *1.6*	4.25 *108.0*	4.5 *2.0*	4.25 *108.0*	7.0 *3.2*	0.88 *22.4*	1.1 *0.5*
108.0mm	2.88 *73.0*	5.5 *2.5*	4.75 *120.7*	8.5 *3.9*	4.75 *120.7*	11.5 *5.2*	-	-
4"	3.00 *76.2*	5.2 *2.4*	5.00 *127.0*	8.5 *3.9*	5.00 *127.0*	11.8 *5.4*	1.00 *25.4*	2.6 *1.2*
133.0mm	3.25 *82.6*	7.7 *3.5*	5.25 *133.4*	11.3 *5.1*	5.25 *133.4*	10.6 *4.8*	-	-
139.7mm	3.25 *82.6*	7.7 *3.5*	5.50 *139.7*	11.3 *5.1*	5.50 *139.7*	15.3 *6.9*	0.92 *23.4*	4.7 *2.1*
5"	3.25 *82.6*	8.5 *3.9*	5.50 *139.7*	13.5 *6.1*	5.50 *139.7*	17.0 *7.7*	1.00 *25.4*	5.0 *2.3*
159.0mm	3.50 *88.9*	12.0 *5.4*	6.00 *152.4*	14.6 *6.6*	6.00 *152.4*	13.9 *6.3*	-	-
165.1mm	3.50 *88.9*	12.0 *5.4*	6.50 *165.1*	18.5 *8.4*	6.50 *165.1*	26.0 *11.8*	1.00 *25.4*	7.5 *3.4*
6"	3.50 *88.9*	12.0 *5.4*	6.50 *165.1*	18.5 *8.4*	6.50 *165.1*	26.0 *11.8*	1.00 *25.4*	7.5 *3.4*
216.3mm	4.25 *108.0*	23.0 *10.4*	7.75 *196.9*	36.5 *16.6*	7.75 *196.9*	45.0 *20.4*	-	-
8"	4.25 *108.0*	23.0 *10.4*	7.75 *196.9*	36.5 *16.6*	7.75 *196.9*	45.0 *20.4*	1.19 *30.2*	12.8 *5.8*
10"	4.75 *120.7*	31.0 *14.1*	9.00 *228.6*	60.0 *27.2*	9.00 *228.6*	72.1 *32.7*	1.25 *31.8*	20.0 *9.1*
12"	5.25 *133.4*	40.0 *18.1*	10.00 *254.0*	67.0 *30.4*	10.00 *254.0*	92.5 *42.0*	1.25 *31.8*	36.0 *16.3*

‡ - Available with tapped plugs, contact Tyco Fire & Building Products.

Figures 501, 510, 519 and 510DE

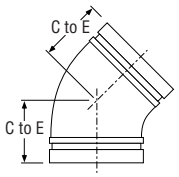


Figure 501

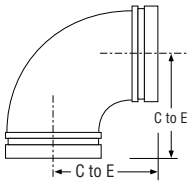


Figure 510

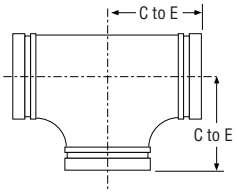


Figure 519

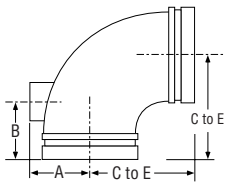


Figure 510DE

Nominal Size	Figure 501 45° Elbow C to E Inches *mm*	Figure 501 45° Elbow Appx. Wt. Lbs. *Kg.*	Figure 510 90° Elbow C to E Inches *mm*	Figure 510 90° Elbow Appx. Wt. Lbs. *Kg.*	Figure 519 Tee C to E Inches *mm*	Figure 519 Tee Appx. Wt. Lbs. *Kg.*	Figure 510DE 90° Drain Elbow C to E Inches *mm*	Figure 510DE 90° Drain Elbow A Inches *mm*	Figure 510DE 90° Drain Elbow B Inches *mm*	Figure 510DE 90° Drain Elbow Appx. Wt. Lbs. *Kg.*
1¼"	1.75 *44.5*	0.9 *0.4*	2.75 *69.9*	1.0 *0.5*	2.75 *69.9*	1.4 *0.6*	-	-	-	-
1½"	1.75 *44.5*	1.1 *0.5*	2.75 *69.9*	1.2 *0.5*	2.75 *69.9*	1.8 *0.8*	-	-	-	-
2"	2.00 *50.8*	1.8 *0.8*	3.25 *82.6*	2.0 *0.9*	3.25 *82.6*	2.7 *1.2*	-	-	-	-
2½"	2.25 *57.2*	2.2 *1.0*	3.75 *95.3*	3.0 *1.4*	3.75 *95.3*	5.8 *2.6*	3.75 *95.3*	2.00 *50.8*	2.75 *69.9*	2.7 *1.2*
3"	2.50 *63.5*	3.5 *1.6*	4.25 *108.0*	4.5 *2.0*	4.25 *108.0*	7.0 *3.2*	4.25 *108.0*	2.34 *59.4*	2.75 *69.9*	3.7 *1.7*
4"	3.00 *76.2*	5.2 *2.4*	5.00 *127.0*	8.5 *3.9*	5.00 *127.0*	11.8 *5.4*	5.00 *127.0*	2.85 *72.4*	2.75 *69.9*	7.0 *3.2*
5"	3.25 *82.6*	8.5 *3.9*	5.50 *139.7*	13.5 *6.1*	5.50 *139.7*	17.0 *7.7*	5.50 *139.7*	3.38 *85.9*	2.75 *69.9*	13.0 *5.9*
6"	3.50 *88.9*	12.0 *5.4*	6.50 *165.1*	18.5 *8.4*	6.50 *165.1*	26.0 *11.8*	6.50 *165.1*	3.92 *99.6*	2.75 *69.9*	13.4 *6.1*
8"	4.25 *108.0*	23.0 *10.4*	7.75 *196.9*	36.5 *16.6*	7.75 *196.9*	45.0 *20.4*	7.75 *196.9*	4.95 *125.7*	2.75 *69.9*	26.3 *11.9*

Figures 501S, 510S and 519S

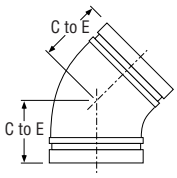


Figure 501S

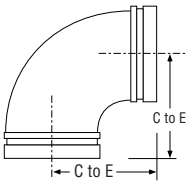


Figure 510S*

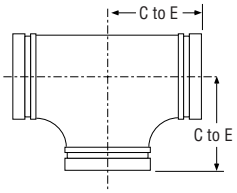


Figure 519S*

Friction Resistance 501S, 510S & 519S (Expressed as Equivalent Straight Pipe)				
Size Inches *mm*	Elbow 90° Feet *Meters*	Elbow 45° Feet *Meters*	Tee Branch Feet *Meters*	Tee Run Feet *Meters*
2 *60.3*	3.2 *1.0*	1.6 *0.5*	8.0 *2.5*	3.2 *1.0*
2½ *73.0*	3.9 *1.2*	2.0 *0.6*	9.8 *3.0*	3.9 *1.2*
76.1mm	4.1 *1.2*	2.1 *0.6*	10.3 *3.1*	4.1 *1.2*
3 *88.9*	4.9 *1.5*	2.4 *0.7*	12.2 *3.7*	4.9 *1.5*
4 *114.3*	6.5 *2.0*	3.3 *1.0*	16.3 *5.0*	6.5 *2.0*
139.7mm	8.0 *2.4*	4.1 *1.3*	20.0 *6.1*	8.0 *2.4*
5 *141.3*	8.2 *2.5*	4.1 *1.3*	20.5 *6.3*	8.2 *2.5*
165.1mm	9.5 *2.9*	4.8 *1.4*	23.8 *7.2*	9.5 *2.9*
6 *168.3*	9.9 *3.0*	5.0 *1.5*	24.8 *7.6*	9.9 *3.0*
8 *219.1*	13.1 *4.0*	6.6 *2.0*	32.8 *10.0*	13.1 *4.0*

Nominal Size	Figure 501S 45° Elbow C to E Inches *mm*	Figure 501S 45° Elbow Appx Wt. Lbs. *Kg.*	Figure 510S 90° Elbow C to E Inches *mm*	Figure 510S 90° Elbow Appx. Wt. Lbs. *Kg.*	Figure 519S Tee C to E Inches *mm*	Figure 519S Tee Appx. Wt. Lbs. *Kg.*
2"	2.00 *50.8*	1.8 *0.8*	2.75 *69.9*	1.5 *0.7*	2.75 *69.9*	2.1 *1.0*
2½"	2.25 *57.2*	2.2 *1.0*	3.00 *76.2*	2.2 *1.0*	3.00 *76.2*	3.0 *1.4*
76.1mm	2.25 *57.2*	2.2 *1.0*	3.00 *76.2*	2.3 *1.0*	3.00 *76.2*	3.1 *1.4*
3"	2.50 *63.5*	3.5 *1.6*	3.38 *85.9*	3.0 *1.3*	3.38 *85.9*	4.1 *1.9*
4"	3.00 *76.2*	5.2 *2.4*	4.00 *101.6*	5.6 *2.6*	4.00 *101.6*	7.7 *3.5*
139.7mm	3.25 *82.6*	7.7 *3.5*	4.88 *124.0*	8.6 *3.9*	4.88 *124.0*	12.0 *5.4*
5"	3.25 *82.6*	8.5 *3.9*	4.88 *124.0*	8.8 *3.9*	4.88 *124.0*	12.0 *5.4*
165.1mm	3.50 *88.9*	12.0 *5.4*	5.50 *139.7*	11.00 *5.0*	5.50 *139.7*	15.0 *6.8*
6"	3.50 *88.9*	12.0 *5.4*	5.50 *139.7*	11.2 *5.1*	5.50 *139.7*	15.2 *6.9*
8"	4.25 *108.0*	23.0 *10.4*	6.88 *174.8*	23.4 *10.6*	6.88 *174.8*	31.2 *14.2*

***Note: Figure 510S and 519S fittings are special short radius fittings with smaller center to end dimensions than standard grooved fittings. Depending on the size and coupling used, there may be interferences at the bolt pads which requires repositioning of the coupling orientation. The use of flange adapters is not recommended with Figures 510S and 519S fittings. Contact Tyco Fire Products for details.**

Figures 250 and 350

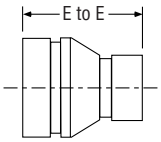


Figure 250
Cast

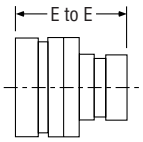


Figure 350
Fabricated
Sizes 3" to 6"

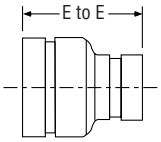


Figure 350
Fabricated
Sizes 8" to 12"

Figures 250 and 350 Concentric Reducer - Groove x Groove								
Nominal Size *Inches*	E to E Inches *mm*	Appx. Wt. Lbs. *Kg.*	Nominal Size *Inches*	E to E Inches *mm*	Appx. Wt. Lbs. *Kg.*	Nominal Size *Inches*	E to E Inches *mm*	Appx. Wt. Lbs. *Kg.*
*2 x 1¼	2.50 *63.5*	1.0 *0.5*	*139.7mm x 3	3.50 *88.9*	4.2 *1.9*	*6 x 5	4.00 *101.6*	5.8 *2.6*
*2 x 1½	2.50 *63.5*	1.3 *0.6*	*139.7mm x 4	3.50 *88.9*	4.4 *2.0*	8 x 2	5.00 *127.0*	12.2 *5.5*
*2½ x 2	2.50 *63.5*	1.2 *0.5*	5 x 1½	3.50 *88.9*	4.6 *2.1*	8 x 2½	5.00 *127.0*	12.1 *5.5*
*76.1mm x 1½	2.50 *63.5*	1.5 *0.7*	5 x 2	3.50 *88.9*	4.6 *2.1*	8 x 3	5.00 *127.0*	12.0 *5.5*
*76.1mm x 2	2.50 *63.5*	1.6 *0.8*	5 x 2½	3.50 *88.9*	4.5 *2.0*	8 x 4	5.00 *127.0*	11.9 *5.4*
3 x 1¼	2.50 *63.5*	1.3 *0.6*	5 x 3	3.50 *88.9*	4.4 *2.0*	8 x 5	5.00 *127.0*	11.3 *5.1*
3 x 1½	2.50 *63.5*	1.3 *0.6*	*5 x 4	3.50 *88.9*	4.5 *2.0*	8 x 6	5.00 *127.0*	10.8 *4.9*
*3 x 2	2.50 *63.5*	1.3 *0.6*	*165.1mm x 3	4.00 *101.6*	5.5 *2.5*	10 x 4	6.00 *152.4*	21.9 *10.0*
*3 x 2½	3.00 *76.2*	1.5 *0.7*	*165.1mm x 4	4.00 *101.6*	6.0 *2.7*	10 x 5	6.00 *152.4*	21.6 *9.8*
*3 x 76.1mm	3.00 *76.2*	2.0 *0.9*	*165.1mm x 139.7mm	4.00 *101.6*	5.6 *2.5*	10 x 6	6.00 *152.4*	21.1 *9.6*
4 x 1¼	3.00 *76.2*	2.2 *1.0*	*6 x 2	4.00 *101.6*	6.0 *2.7*	10 x 8	6.00 *152.4*	19.5 *8.9*
4 x 1½	3.00 *76.2*	2.3 *1.0*	6 x 2½	4.00 *101.6*	6.0 *2.7*	12 x 4	7.00 *177.8*	28.0 *12.7*
*4 x 2	3.00 *76.2*	2.3 *1.0*	*6 x 76.1mm	4.00 *101.6*	6.0 *2.7*	12 x 6	7.00 *177.8*	30.0 *13.6*
*4 x 2½	3.00 *76.2*	2.3 *1.0*	6 x 3	4.00 *101.6*	6.0 *2.7*	12 x 8	7.00 *177.8*	28.0 *12.7*
*4 x 76.1mm	3.00 *76.2*	3.2 *1.5*	*6 x 4	4.00 *101.6*	5.9 *2.7*	12 x 10	7.00 *177.8*	33.0 *15.0*
4 x 3	3.00 *76.2*	2.6 *1.2*	*6 x 139.7mm	4.00 *101.6*	6.3 *2.9*			

Note: Sizes marked with an asterisk (*) are only available in Figure 250 Cast.
Sizes without an asterisk are only available in Figure 350 Fabricated.

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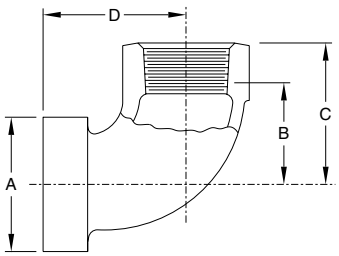

Pipe		Nominal Dimensions				Net Wt. Lbs. *Kg.*
		O.D.	Takeout	Center to End		
Size Inches	Outlet NPT* Inches	A Inches *mm*	B Inches *mm*	C Inches *mm*	D Inches *mm*	
1½	½	1.900 *48.3*	1.25 *31.8*	1.75 *44.5*	1.89 *48.0*	0.77 *0.3*
	¾		1.25 *31.8*	1.75 *44.5*	1.89 *48.0*	0.77 *0.3*
	1		1.37 *34.8*	2.00 *50.8*	2.02 *51.3*	0.88 *0.4*
2	½	2.375 *60.3*	1.25 *31.8*	1.75 *44.5*	1.89 *48.0*	0.92 *0.4*
	¾		1.25 *31.8*	1.75 *44.5*	1.89 *48.0*	0.92 *0.4*
	1		1.37 *34.8*	2.00 *50.8*	2.02 *51.3*	1.06 *0.5*
2½	½	2.875 *73.0*	1.47 *37.3*	1.97 *50.0*	1.89 *48.0*	1.28 *0.6*
	¾		1.47 *37.3*	1.97 *50.0*	1.89 *48.0*	1.28 *0.6*
	1		1.37 *34.8*	2.00 *50.8*	2.02 *51.3*	1.50 *0.7*

* ISO-7 threaded outlets are available upon request.

Figures 391, 392, 393, 312 and 313

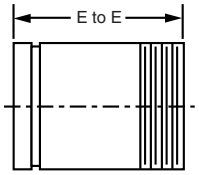

Figure 391

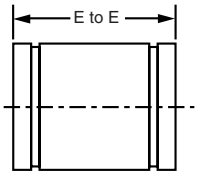

Figure 392

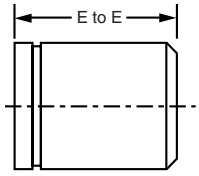

Figure 393

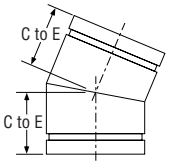

Figure 312

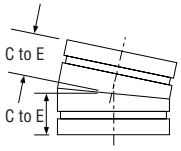

Figure 313

Nominal Size	Figures 391, 392 and 393 Adapter Nipples E to E Inches *mm*	Appx. Wt. Lbs. *Kg.*	Figure 312 22½° Elbow C to E Inches *mm*	Appx. Wt. Lbs. *Kg.*	Figure 313 11¼° Elbow C to E Inches *mm*	Appx. Wt. Lbs. *Kg.*
1¼"	4.00 *101.6*	0.8 *0.4*	1.75 *44.5*	0.4 *0.2*	1.38 *35.1*	0.4 *0.2*
1½"	4.00 *101.6*	0.9 *0.4*	1.75 *44.5*	0.5 *0.2*	1.38 *35.1*	0.5 *0.2*
2"	4.00 *101.6*	1.2 *0.5*	1.88 *47.8*	0.6 *0.3*	1.38 *35.1*	0.6 *0.3*
2½"	4.00 *101.6*	1.9 *0.9*	2.00 *50.8*	0.7 *0.3*	1.50 *38.1*	1.1 *0.5*
3"	4.00 *101.6*	2.5 *1.1*	2.25 *57.2*	1.4 *0.6*	1.50 *38.1*	1.2 *0.5*
4"	6.00 *152.4*	5.5 *2.5*	2.63 *66.8*	2.4 *1.1*	1.75 *44.5*	2.2 *1.0*
5"	6.00 *152.4*	7.4 *3.4*	2.88 *73.2*	4.1 *1.9*	2.00 *50.8*	3.3 *1.5*
6"	6.00 *152.4*	9.5 *4.3*	3.13 *79.5*	5.6 *2.5*	2.00 *50.8*	4.6 *2.1*
8"	6.00 *152.4*	14.2 *6.4*	3.88 *98.6*	11.1 *5.0*	2.00 *50.8*	8.7 *3.9*
10"	8.00 *203.2*	27.0 *12.2*	4.38 *11.3*	14.0 *6.4*	2.13 *54.1*	9.1 *4.1*
12"	8.00 *203.2*	33.0 *15.0*	4.88 *124.0*	22.0 *10.0*	2.25 *57.2*	16.7 *7.6*

Figures 327 and 341

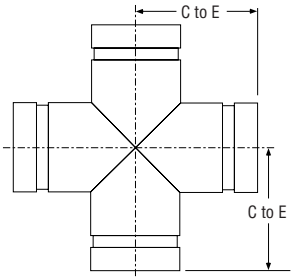

Figure 327

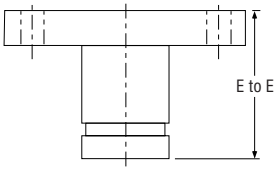

Figure 341

Nominal Size	Figure 327 Cross C to E nches *mm*	Appx. Wt. Lbs. *kg.*	Figure 341 150 lbs. Flange Adapter E to E Inches *mm*	Appx. Wt. Lbs. *kg.*
1¼"	2.75 *69.6*	2.0 *0.9*	4.00 *101.6*	2.8 *1.3*
1½"	2.75 *69.9*	2.2 *2.0*	4.00 *101.6*	3.2 *1.5*
2"	3.25 *82.6*	2.7 *1.2*	4.0 *101.6*	5.2 *2.4*
2½"	3.75 *95.3*	5.0 *2.3*	4.00 *101.6*	8.0 *3.6*
3"	4.25 *108.0*	7.1 *3.2*	4.00 *101.6*	10.2 *4.6*
4"	5.00 *127.0*	11.9 *5.4*	6.00 *152.4*	17.2 *7.8*
5"	5.50 *139.7*	17.1 *7.8*	6.00 *152.4*	21.4 *9.7*
6"	6.50 *165.1*	27.5 *12.5*	6.00 *152.4*	26.0 *11.8*
8"	7.75 *196.9*	47.0 *21.3*	6.00 *152.4*	38.4 *17.4*
10"	9.00 *228.6*	68.0 *30.8*	8.00 *203.2*	65.0 *29.5*
12"	10.00 *254.0*	107.0 *48.5*	8.00 *203.2*	91.0 *41.3*

Figure 321

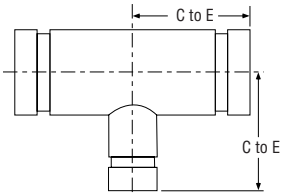

Figure 321

Figure 321 Reducing Tee					
Nominal Size Inches	C to E Inches *mm*	Appx. Wt. Lbs. *Kg.*	Nominal Size Inches	C to E Inches *mm*	Appx. Wt. Lbs. *Kg.*
1½ x 1½ x 1¼	3.25 *82.6*	2.0 *0.9*	6 x 6 x 4	6.50 *165.1*	26.6 *12.1*
2 x 2 x 1½	3.25 *82.6*	2.7 *1.2*	6 x 6 x 5	6.50 *165.1*	27.0 *12.2*
2½ x 2½ x 1¼	3.75 *95.3*	4.2 *1.9*	8 x 8 x 2	7.75 *196.9*	36.2 *16.4*
2½ x 2½ x 1½	3.75 *95.3*	4.2 *1.9*	8 x 8 x 3	7.75 *196.9*	36.5 *16.6*
2½ x 2½ x 2	3.75 *95.3*	4.3 *2.0*	8 x 8 x 4	7.75 *196.9*	36.6 *16.6*
3 x 3 x 1½	4.25 *108.0*	5.3 *2.4*	8 x 8 x 5	7.75 *196.9*	36.8 *16.7*
3 x 3 x 2	4.25 *108.0*	5.5 *2.5*	8 x 8 x 6	7.75 *196.9*	37.0 *16.8*
3 x 3 x 2½	4.25 *108.0*	5.8 *2.6*	10 x 10 x 2	9.00 *228.6*	57.1 *25.9*
4 x 4 x 1¼	5.00 *127.0*	9.8 *4.4*	10 x 10 x 3	9.00 *228.6*	57.4 *26.0*
4 x 4 x 1½	5.00 *127.0*	9.9 *4.5*	10 x 10 x 4	9.00 *228.6*	57.6 *26.1*
4 x 4 x 2	5.00 *127.0*	10.1 *4.6*	10 x 10 x 5	9.00 *228.6*	57.8 *26.2*
4 x 4 x 2½	5.00 *127.0*	10.3 *4.7*	10 x 10 x 6	9.00 *228.6*	58.0 *26.3*
4 x 4 x 3	5.00 *127.0*	10.5 *4.8*	10 x 10 x 8	9.00 *228.6*	58.4 *26.5*
5 x 5 x 2	5.50 *139.7*	14.5 *6.6*	12 x 12 x 3	10.00 *254.0*	80.2 *36.4*
5 x 5 x 2½	5.50 *139.7*	14.8 *6.7*	12 x 12 x 4	10.00 *254.0*	80.5 *36.5*
5 x 5 x 3	5.50 *139.7*	15.2 *6.9*	12 x 12 x 5	10.00 *254.0*	80.7 *36.6*
5 x 5 x 4	5.50 *139.7*	15.8 *7.2*	12 x 12 x 6	10.00 *254.0*	80.9 *36.7*
6 x 6 x 2	6.50 *165.1*	26.5 *11.9*	12 x 12 x 8	10.00 *254.0*	91.4 *41.5*
6 x 6 x 2½	6.50 *165.1*	26.5 *12.0*	12 x 12 x 10	10.00 *254.0*	91.8 *41.6*
6 x 6 x 3	6.50 *165.1*	26.5 *12.0*			

General Notes: It is the Designer's responsibility to select products suitable for the intended service and to ensure that pressure ratings and performance data is not exceeded. Always read and understand the installation instructions (IH-1000). Never remove any piping component or correct or modify any piping deficiencies without first depressurizing and draining the system. Material and gasket selection should be verified to be compatible for the specific application.

ISO 9001 Certified Company

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Grinnell Grooved Fire Protection Products
Figure 577
Rigid Coupling - Patented

General Description

See Fire Protection Submittal Sheet for Pressure Rating and Listing/Approval Information

The Figure 577 Rigid Coupling provides a rigid joint by firmly gripping along the circumference of the pipe grooves. Rigid couplings are preferred for dry pipe and freezer applications. Figure 577 Rigid Couplings are a proven dependable method of joining pipe and are an economical alternative to welding, threading, or using flanges. It is capable of pressures up to 300 psig (2069 kPa) depending on pipe size and wall thickness when used in fire protection services.

Rigid Couplings are recommended for dry pipe and freezer applications.

WARNING

The Figure 577 Rigid Coupling described herein must be installed and maintained in compliance with this document, in addition to the standards of any other authorities having jurisdiction. ***Failure to do so may impair the integrity of this device.***

The owner is responsible for maintaining their system and devices in proper operating condition. The installing contractor or manufacturer should be contacted with any questions.

Technical Data

Figure: 577
Sizes: 1-1/4" - 8"
Approvals: UL, FM, ULC, VdS, and LPCB; See Fire Protection Submittal Sheet for exact Listing/Approval information.
Housing: Ductile iron conforming to ASTM A-536, Grade 65-45-12.
Protective Coatings:
- Non-lead orange paint.
- Fire brigade red (optional) non-lead paint.
- Hot dipped galvanized conforming to ASTM A-153.

Bolts/Nuts: Track Head Bolts - conforming to ASTM A-183, Zinc Plated, (Min. Tensile = 110,000 psi/758,422 kPa). Metric - conforming to ASTM F568M.
Gasket:
- Prelubricated Grade “A” EPDMA violet color code ambient to +150°F (+66°C) for fire protection systems. Not recommended for hot water systems.
- Tri-seal (Grade “E” EPDM), green color code for use in dry pipe or freezer system.

(See Data Sheet TFP1865 for aid in selecting proper gasket.)

Ordering Information

When placing an order, indicate the full product name. Please specify the quantity, figure number, type of gasket, Grade “A” EPDMA, Prelubricated (Grade “A” EPDMA) or Grade “E” EPDM Tri-Seal, and size.

Grinnell Grooved Piping Products, valves, accessories, and other products are available throughout the U.S., Canada, and internationally, through a network of distribution centers. You may write directly or call 215-362-0700 for the distributor nearest you.

Care and Maintenance

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any authority having jurisdiction. The installing contractor or sprinkler manufacturer should be contacted relative to any questions.

It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

Limited Warranty

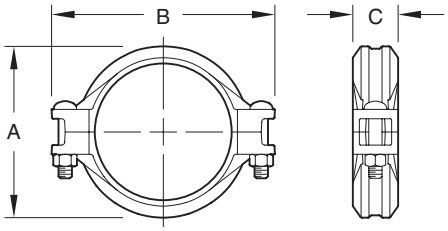
Products manufactured by Tyco Fire & Building Products are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by Tyco Fire & Building Products. No warranty is given for products or components manufactured by companies not affiliated by ownership with Tyco Fire & Building Products or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the the standards of any other Authorities Having Jurisdiction. Materials found by Tyco Fire & Building Products to be defective shall be either repaired or replaced, at Tyco Fire & Building Products’ sole option. Tyco Fire & Building Products neither

assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. Tyco Fire & Building Products shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

IN NO EVENT SHALL TYCO FIRE & BUILDING PRODUCTS BE LIABLE, IN CONTRACT, TORT, STRICT LIABILITY OR UNDER ANY OTHER LEGAL THEORY, FOR INCIDENTAL, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LABOR CHARGES, REGARDLESS OF WHETHER TYCO FIRE & BUILDING PRODUCTS WAS INFORMED ABOUT THE POSSIBILITY OF SUCH DAMAGES, AND IN NO EVENT SHALL TYCO FIRE & BUILDING PRODUCTS' LIABILITY EXCEED AN AMOUNT EQUAL TO THE SALES PRICE.

THE FOREGOING WARRANTY IS MADE IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Figure 577 Grooved Coupling



Pipe		Max.* ‡	Max. †	Max. †	Nominal Dimensions			Bolt	Net
Size	O.D. Inches *mm*	End Gap Inches *mm*	Pressure psi *kPa*	End Load Lbs. *N*	A Inches *mm*	B Inches *mm*	C Inches *mm*	Size** Dia. x Lg.	Weight Lbs. *Kg*
1 1/4"	1.660 *42.4*	0.06 *1.5*	300 *2,068*	649 *2,888*	2.68 *68*	4.21 *107*	1.65 *42*	3/8" x 2 1/4" *M10 x 57*	1.3 *0.6*
1 1/2"	1.900 *48.3*	0.06 *1.5*	300 *2,068*	851 *3,783*	2.91 *74*	4.45 *113*	1.65 *42*	3/8" x 2 1/4" *M10 x 57*	1.5 *0.7*
2"	2.375 *60.3*	0.06 *1.5*	300 *2,068*	1329 *5,912*	3.39 *86*	5.00 *127*	1.69 *43*	3/8" x 2 1/4" *M10 x 57*	1.8 *0.8*
2 1/2"	2.875 *73.0*	0.06 *1.5*	300 *2,068*	1947 *8,663*	3.90 *99*	5.43 *138*	1.77 *45*	3/8" x 2 1/4" *M10 x 57*	2.0 *0.9*
76.1 mm	3.000 *76.1*	0.06 *1.5*	300 *2,068*	2121 *9,433*	3.98 *101*	5.59 *142*	1.77 *45*	3/8" x 2 1/4" *M10 x 57*	2.0 *0.9*
3"	3.500 *88.9*	0.06 *1.5*	300 *2,068*	2886 *12,839*	4.49 *114*	6.14 *156*	1.77 *45*	3/8" x 2 1/4" *M10 x 57*	3.3 *1.5*
4"	4.500 *114.3*	0.19 *4.8*	300 *2,068*	4771 *21,223*	5.71 *145*	7.52 *191*	1.85 *47*	3/8" x 2 1/4" *M10 x 57*	3.3 *1.5*
139.7 mm	5.500 *139.7*	0.19 *4.8*	300 *2,068*	7127 *31,704*	6.81 *173*	8.74 *222*	1.93 *49*	1/2" x 3" *M12 x 76*	5.3 *2.4*
5"	5.563 *141.3*	0.19 *4.8*	300 *2,068*	7291 *32,434*	6.85 *174*	8.82 *224*	1.93 *49*	1/2" x 3" *M12 x 76*	5.3 *2.4*
165.1 mm	6.500 *165.1*	0.19 *4.8*	300 *2,068*	9955 *44,280*	7.80 *198*	9.76 *248*	1.93 *49*	1/2" x 3" *M12 x 76*	5.7 *2.6*
6"	6.625 *168.3*	0.19 *4.8*	300 *2,068*	10341 *46,000*	7.91 *201*	9.88 *251*	1.93 *49*	1/2" x 3" *M12 x 76*	5.9 *2.7*
8"	8.625 *219.1*	0.19 *4.8*	300 *2,068*	17527 *77,966*	10.24 *260*	12.80 *325*	2.40 *61*	5/8" x 3 1/4" *M16 x 83*	11.7 *5.3*

* Maximum available gap between pipe ends. Minimum gap = 0.

† Maximum pressure and end load are total from all loads based on standard weight steel pipe. Pressure ratings and end loads may differ on other pipe materials and/or wall thickness. Contact Tyco Fire & Building Products for details. See Fire Protection Equipment Submittal Sheet for Listing and Approval pressure ratings.

** Gold color coded metric bolt sizes are available upon request.

‡ Max. End Gap is for cut grooved standard weight pipe. Valves for roll grooved pipe will be 1/2 that of cut grooved.

Figure 577 Rigid Couplings have an Anti-Rotation Feature of "gripping teeth" along the coupling keys, which make the Figure 577 perfectly suited for "arm over" installations where the likelihood of rotation is greatest. This feature may eliminate the need of extra hangers to support the arm over due to increased rigidity and gripping force saving time and cost.

General Notes: It is the Designer's responsibility to select products suitable for the intended service and to ensure that pressure ratings and performance data is not exceeded. Always read and understand the installation instructions (IH-1000). Never remove any piping component or correct or modify any piping deficiencies without first depressurizing and draining the system. Material and gasket selection should be verified to be compatible for the specific application.

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Grinnell Grooved Fire Protection Products
Figure 772
Rigid Coupling - Patented

General Description

See Fire Protection Submittal Sheet for Pressure Rating and Listing/Approval Information

The Figure 772 Rigid Coupling provides a rigid joint by firmly gripping along the circumference of the pipe grooves. Rigid couplings are preferred for dry pipe and freezer applications. Figure 772 Rigid Couplings are a proven dependable method of joining pipe and are an economical alternative to welding, threading or using flanges. It is capable of pressures up to 500 psig (3447 kPa) depending on pipe size and wall thickness when used in fire protection services.

Rigid Couplings are recommended for dry pipe and freezer applications.

WARNING

The Figure 772 Rigid Coupling described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. ***Failure to do so may impair the performance of this device.***

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.

Technical Data

Figure: 772

Sizes: 1¼" - 12"

Approvals: UL, FM, ULC, VdS, and LPCB; See Fire Protection Submittal Sheet for exact Listing / Approval information.

Housing: Ductile iron conforming to ASTM A-536, Grade 65-45-12

Protective Coatings:
- Non-lead orange paint
- Fire brigade red (optional) non-lead paint
- Hot dipped galvanized conforming to ASTM A-153

Bolt/Nuts: Track Head Bolts - conforming to ASTM A-183, Zinc Plated, (Min. Tensile = 110,000 psi/758,422 kPa)
Metric - conforming to ASTM F568M

Gasket: (specify when ordering)
- Grade "A" EPDMA violet color code ambient to +150°F (+66°C) for fire protection systems. Not recommended for hot water systems.
- Tri-seal (Grade "E" EPDM), green color code for use in dry pipe or freezer systems.
- Prelubricated (Grade "A" EPDMA)

(See Data Sheet TFP1895 for aid in selecting proper gasket)

Ordering Procedure

When placing an order, indicate the full product name. Please specify the quantity, figure number, type of gasket, Grade "A" EPDMA, Prelubricated (Grade "A" EPDMA) or Grade "E" EPDM Tri-Seal, and size.

Grinnell Grooved Piping Products, valves, accessories and other products are available throughout the U.S., Canada, and internationally, through a network of distribution centers. You may write directly or call 215-362-0700 for the distributor nearest you.

Care and Maintenance

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in accordance with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any authority having jurisdiction. The installing contractor or product manufacturer should be contacted relative to any questions. Any impairment must be immediately corrected. It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service.

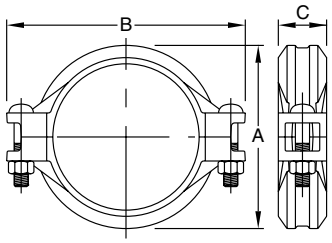
Limited Warranty

Products manufactured by Tyco Fire Products are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by Tyco Fire Products. No warranty is given for products or components manufactured by companies not affiliated by ownership with Tyco Fire Products or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association (NFPA), and/or the standards of any other Authorities Having Jurisdiction. Materials found by Tyco Fire Products to be defective shall be either repaired or replaced, at Tyco Fire Products' sole option. Tyco Fire Products neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. Tyco Fire Products shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

IN NO EVENT SHALL TYCO FIRE PRODUCTS BE LIABLE, IN CONTRACT, TORT, STRICT LIABILITY OR UNDER ANY OTHER LEGAL THEORY, FOR INCIDENTAL, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LABOR CHARGES, REGARDLESS OF WHETHER TYCO FIRE PRODUCTS WAS INFORMED ABOUT THE POSSIBILITY OF SUCH DAMAGES, AND IN NO EVENT SHALL TYCO FIRE PRODUCTS' LIABILITY EXCEED AN AMOUNT EQUAL TO THE SALES PRICE.

THE FOREGOING WARRANTY IS MADE IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Figure 772 Grooved Coupling



Pipe		Max.*‡	Max.†	Max.†	Nominal Dimensions			Bolt	Net
Size	O.D. Inches *mm*	End Gap Inches *mm*	Pressure psi *kPa*	End Load Lbs. *N*	A Inches *mm*	B Inches *mm*	C Inches *mm*	Size** Dia. x Lg.	Wt. Lbs. *Kg.*
1¼"	1.660 *42.4*	0.06 *1.5*	300 *2,068*	649 *2,887*	2.75 *69.9*	4.38 *111.3*	1.81 *46.0*	⅜" x 2¼" *M10 x 57*	1.0 *0.5*
1½"	1.900 *48.3*	0.08 *2.0*	500 *3,447*	1,417 *6,303*	3.00 *76.2*	4.62 *117.3*	1.81 *46.0*	⅜" x 2¼" *M10 x 57*	1.0 *0.5*
2"	2.375 *60.3*	0.13 *3.3*	500 *3,447*	2,214 *9,848*	3.41 *86.6*	5.12 *130.0*	1.88 *47.8*	⅜" x 2¼" *M10 x 57*	1.5 *0.7*
2½"	2.875 *73.0*	0.13 *3.3*	500 *3,447*	3,244 *14,430*	3.91 *99.3*	5.63 *143.0*	1.88 *47.8*	⅜" x 2¼" *M10 x 57*	2.5 *1.1*
76.1mm	3.000 *76.1*	0.13 *3.3*	300 *2,068*	2,120 *9,430*	4.19 *106.4*	5.72 *145.3*	2.00 *50.8*	M10 x 57	2.6 *1.2*
3"	3.500 *88.9*	0.13 *3.3*	500 *3,447*	4,808 *21,387*	4.63 *117.6*	6.25 *158.8*	1.88 *47.8*	⅜" x 2¼" *M10 x 57*	2.6 *1.2*
4"	4.500 *114.3*	0.19 *4.8*	500 *3,447*	7,948 *35,353*	5.81 *147.6*	7.50 *190.5*	1.97 *50.0*	⅜" x 2¼" *M10 x 57*	3.5 *1.6*
139.7mm	5.500 *139.7*	0.19 *4.8*	300 *2,068*	7,127 *31,701*	7.02 *178.3*	9.72 *246.9*	2.06 *52.3*	M16 x 83	7.5 *3.4*
5"	5.563 *141.3*	0.19 *4.8*	300 *2,068*	7,288 *32,417*	7.09 *180.1*	9.71 *246.6*	2.04 *51.8*	⅝" x 3¼" *M16 x 83*	7.5 *3.4*
165.1mm	6.500 *165.1*	0.19 *4.8*	300 *2,068*	9,950 *44,258*	8.09 *205.5*	10.53 *267.5*	2.13 *54.1*	M16 x 83	7.6 *3.4*
6"	6.625 *168.3*	0.19 *4.8*	400 *2,758*	13,782 *61,302*	8.09 *205.5*	10.53 *267.5*	2.13 *54.1*	⅝" x 3¼" *M16 x 83*	7.6 *3.4*
8"	8.625 *219.1*	0.19 *4.8*	450 *3,103*	26,278 *116,885*	10.56 *268.2*	13.56 *344.4*	2.62 *66.5*	¾" x 4¾" *M20 x 121*	18.0 *8.2*
10"	10.750 *273.0*	0.13 *3.3*	250 *1,724*	22,679 *100,876*	12.84 *326.1*	16.41 *416.8*	2.62 *66.5*	1" x 6½" *M24 x 165*	24.6 *11.2*
12"	12.750 *323.9*	0.13 *3.3*	250 *1,724*	31,903 *141,905*	15.41 *391.4*	18.84 *478.5*	2.62 *66.5*	1" x 6½" *M24 x 165*	42.0 *19.1*

* Maximum available gap between pipe ends. Minimum gap = 0.

† Maximum pressure and end load are total from all loads based on standard weight steel pipe. Pressure ratings and end loads may differ on other pipe materials and/or wall thickness. Contact Tyco Fire Products for details. See Fire Protection Equipment Submittal Sheet for Listing and Approval pressure ratings.

** Gold color coded metric bolt sizes are available upon request.

‡ Max End Gap is for cut grooved standard weight pipe. Values for roll grooved pipe will be ½ that of cut grooved.

Figure 772 Rigid Couplings have an Anti-Rotation Feature of “gripping teeth” along the coupling keys in sizes 1¼" - 4", which make the Figure 772 perfectly suited for “arm over” installations where the likelihood of rotation is greatest. This feature may eliminate the need of extra hangers to support the arm over due to increased rigidity and gripping force saving time and cost.

General Notes: It is the Designer’s responsibility to select products suitable for the intended service and to ensure that pressure ratings and performance data is not exceeded. Always read and understand the installation instructions (IH-1000). Never remove any piping component or correct or modify any piping deficiencies without first depressurizing and draining the system. Material and gasket selection should be verified to be compatible for the specific application.

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Grinnell Grooved Fire Protection Products
Figure 705
Flexible Coupling

General Description

See Fire Protection Submittal Sheet for Pressure Rating and Listing/Approval Information

The Figure 705 Flexible Coupling is capable of pressures up to 300 psig (2068 kPa) depending on pipe size and wall thickness when used in fire protection services. It provides a dependable method of joining pipe and is suitable for use in a variety of applications.

Rigid Couplings are recommended for dry pipe and freezer applications.

WARNING

The Figure 705 Flexible Coupling described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. ***Failure to do so may impair the performance of this device.***

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.

Technical Data

Figure: 705

Sizes: 1¼" - 12"

Approvals: UL, FM, ULC, VdS, and LPCB; See Fire Protection Submittal Sheet for exact Listing / Approval information.

Housing: Ductile iron conforming to ASTM A-536, Grade 65-45-12

Protective Coatings:
- Non-lead orange paint
- Fire brigade red (optional) non-lead paint
- Hot dipped galvanized conforming to ASTM A-153

Bolt/Nuts: Track Head Bolts - conforming to ASTM A-183, Zinc Plated, (Min. Tensile = 110,000 psi/758,422 kPa)
Metric - conforming to ASTM F568M

Gasket: (specify when ordering)
- Grade "A" EPDMA violet color code ambient to +150°F (+66°C) for fire protection systems. Not recommended for hot water systems.
- Tri-seal (Grade "E" EPDM), green color code.
- Prelubricated (Grade "A" EPDMA)

(See Data Sheet TFP1895 for aid in selecting proper gasket)

Ordering Procedure

When placing an order, indicate the full product name. Please specify the quantity, figure number, type of gasket, Grade "A" EPDMA, Prelubricated (Grade "A" EPDMA) or Grade "E" EPDM Tri-Seal, and size.

Grinnell Grooved Piping Products, valves, accessories and other products are available throughout the U.S., Canada, and internationally, through a network of distribution centers. You may write directly or call 215-362-0700 for the distributor nearest you.

Care and Maintenance

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in accordance with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any authority having jurisdiction. The installing contractor or product manufacturer should be contacted relative to any questions. Any impairment must be immediately corrected.

It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service.

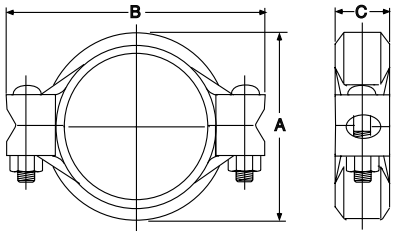
Limited Warranty

Products manufactured by Tyco Fire Products are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by Tyco Fire Products. No warranty is given for products or components manufactured by companies not affiliated by ownership with Tyco Fire Products or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association (NFPA), and/or the standards of any other Authorities Having Jurisdiction. Materials found by Tyco Fire Products to be defective shall be either repaired or replaced, at Tyco Fire Products' sole option. Tyco Fire Products neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. Tyco Fire Products shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

IN NO EVENT SHALL TYCO FIRE PRODUCTS BE LIABLE, IN CONTRACT, TORT, STRICT LIABILITY OR UNDER ANY OTHER LEGAL THEORY, FOR INCIDENTAL, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LABOR CHARGES, REGARDLESS OF WHETHER TYCO FIRE PRODUCTS WAS INFORMED ABOUT THE POSSIBILITY OF SUCH DAMAGES, AND IN NO EVENT SHALL TYCO FIRE PRODUCTS' LIABILITY EXCEED AN AMOUNT EQUAL TO THE SALES PRICE.

THE FOREGOING WARRANTY IS MADE IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Figure 705 Grooved Coupling



Pipe		Max. *‡	Max.†	Max.†	Nominal Dimensions			Deflection ‡		Bolt	Net
Size	O.D. Inches *mm*	End Gap Inches *mm*	Pressure psi *kPa*	End load Lbs. *N*	A Inches *mm*	B Inches *mm*	C Inches *mm*	°Per Coupling	Inches/ Foot *mm/m*	Size** Dia. x Lg.	Wt. Lbs. *Kg.*
1¼"	1.660 *42.4*	0.13 *3.3*	300 *2,068*	649 *2,887*	2.56 *65.0*	4.19 *106.4*	1.81 *46.0*	4° - 19'	0.90 *75.0*	3/8" x 2 1/4" *M10 x 57*	1.5 *0.7*
1½"	1.900 *48.3*	0.13 *3.3*	300 *2,068*	850 *3,781*	2.75 *69.9*	4.44 *112.8*	1.81 *46.0*	3° - 46'	0.79 *65.8*	3/8" x 2 1/4" *M10 x 57*	1.6 *0.7*
2"	2.375 *60.3*	0.13 *3.3*	300 *2,068*	1,328 *5,907*	3.25 *82.6*	4.88 *124.0*	1.88 *47.8*	3° - 1'	0.63 *52.5*	3/8" x 2 1/4" *M10 x 57*	1.7 *0.8*
2½"	2.875 *73.0*	0.13 *3.3*	300 *2,068*	1,947 *8,660*	3.69 *93.7*	5.50 *139.7*	1.88 *47.8*	2° - 29'	0.52 *43.3*	3/8" x 2 1/4" *M10 x 57*	2.0 *0.9*
76.1mm	3.000 *76.1*	0.13 *3.3*	300 *2,068*	2,120 *9,430*	4.00 *101.6*	5.75 *146.1*	1.88 *47.8*	2° - 23'	0.50 *41.7*	M12 x 76	3.1 *1.4*
3"	3.500 *88.9*	0.13 *3.3*	300 *2,068*	2,885 *12,832*	4.38 *111.3*	6.50 *165.1*	1.88 *47.8*	2° - 3'	0.43 *35.8*	1/2" x 3" *M12 x 76*	3.0 *1.4*
108.0mm	4.250 *108.0*	0.25 *6.4*	300 *2,068*	4,256 *18,931*	5.50 *139.7*	7.50 *190.5*	2.06 *52.3*	3° - 22'	0.70 *58.3*	M12 x 76	4.2 *1.9*
4"	4.500 *114.3*	0.25 *6.4*	300 *2,068*	4,769 *21,213*	5.69 *144.5*	7.75 *196.9*	2.06 *52.3*	3° - 11'	0.67 *55.8*	1/2" x 3" *M12 x 76*	4.0 *1.8*
133.0mm	5.250 *133.0*	0.25 *6.4*	300 *2,068*	6,494 *28,885*	6.56 *166.6*	9.50 *241.3*	2.06 *52.3*	2° - 44'	0.56 *46.7*	M16 x 83	7.2 *3.3*
139.7mm	5.500 *139.7*	0.25 *6.4*	300 *2,068*	7,127 *31,701*	6.81 *173.0*	9.75 *247.7*	2.06 *52.3*	2° - 36'	0.56 *46.7*	M16 x 83	7.2 *3.3*
5"	5.563 *141.3*	0.25 *6.4*	300 *2,068*	7,288 *32,417*	6.88 *174.8*	9.75 *247.7*	2.06 *52.3*	2° - 35'	0.54 *45.0*	5/8" x 3 1/4" *M16 x 83*	7.0 *3.2*
159.0mm	6.250 *159.0*	0.25 *6.4*	300 *2,068*	9,204 *40,939*	7.56 *192.0*	10.31 *261.9*	2.06 *52.3*	2° - 17'	0.48 *40.0*	M16 x 83	7.4 *3.4*
165.1mm	6.500 *165.1*	0.25 *6.4*	300 *2,068*	9,950 *44,258*	7.75 *196.9*	10.69 *271.5*	2.06 *52.3*	2° - 12'	0.46 *38.3*	M16 x 83	7.1 *3.2*
6"	6.625 *168.3*	0.25 *6.4*	300 *2,068*	10,336 *45,975*	7.94 *201.7*	10.69 *271.5*	2.06 *52.3*	2° - 10'	0.45 *37.5*	5/8" x 3 1/4" *M16 x 83*	7.1 *3.2*
216.3mm	8.500 *216.3*	0.25 *6.4*	300 *2,068*	17,024 *75,723*	10.07 *255.8*	13.50 *342.9*	2.31 *58.7*	1° - 40'	0.35 *29.2*	M20 x 121	12.4 *5.6*
8"	8.625 *219.1*	0.25 *6.4*	300 *2,068*	17,519 *77,925*	10.19 *258.8*	13.56 *344.4*	2.50 *63.5*	1° - 40'	0.35 *29.2*	3/4" x 4 3/4" *M20 x 121*	14.5 *6.6*
10"	10.750 *273.0*	0.25 *6.4*	250 *1,724*	22,679 *100,876*	12.69 *322.3*	16.38 *416.1*	2.63 *66.8*	1° - 20'	0.28 *23.3*	1" x 6 1/2" *M24 x 165*	28.0 *12.7*
12"	12.750 *323.9*	0.25 *6.4*	250 *1,724*	31,903 *141,905*	14.94 *379.5*	18.88 *479.6*	2.63 *66.8*	1° - 7'	0.23 *19.2*	1" x 6 1/2" *M24 x 165*	36.5 *16.6*

* Maximum available gap between pipe ends. Minimum gap = 0.

† Maximum pressure and end load are total from all loads based on standard weight steel pipe. Pressure ratings and end loads may differ on other pipe materials and/or wall thickness. Contact Tyco Fire Products for details. See Fire Protection Equipment Submittal Sheet for Listing and Approval pressure ratings.

** Gold color coded metric bolt sizes are available upon request.

‡ Max End Gap and Deflection is for cut grooved standard weight pipe. Values for roll grooved pipe will be ½ that of cut grooved.

General Notes: It is the Designer's responsibility to select products suitable for the intended service and to ensure that pressure ratings and performance data is not exceeded. Always read and understand the installation instructions (IH-1000). Never remove any piping component or correct or modify any piping deficiencies without first depressurizing and draining the system. Material and gasket selection should be verified to be compatible for the specific application.

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Grinnell Grooved Fire Protection Products
Figure 707
Flexible Coupling

General Description

See Fire Protection Submittal Sheet for Pressure Rating and Listing/Approval Information

The Figure 707 Flexible Coupling is capable of pressures up to 500 psig (3447 kPa) depending on pipe size and wall thickness when used in fire protection services. It provides a dependable method of joining pipe and is suitable for use in a variety of applications.

Rigid Couplings are recommended for dry pipe and freezer applications.

WARNING

The Figure 707 Flexible Coupling described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. ***Failure to do so may impair the performance of this device.***

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.

Technical Data

Figure: 707

Sizes: 1½" - 12"

Approvals: UL, FM, ULC, VdS, and LPCB; See Fire Protection Submittal Sheet for exact Listing / Approval information.

Housing: Ductile iron conforming to ASTM A-536, Grade 65-45-12

Protective Coatings:
- Non-lead orange paint
- Fire brigade red (optional) non-lead paint
- Hot dipped galvanized conforming to ASTM A-153

Bolt/Nuts: Track Head Bolts - conforming to ASTM A-183, Zinc Plated, (Min. Tensile = 110,000 psi/758,422 kPa)
Metric - conforming to ASTM F568M

Gasket: (specify when ordering)
- Grade "A" EPDMA violet color code ambient to +150°F (+66°C) for fire protection systems. Not recommended for hot water systems.
- Tri-seal (Grade "E" EPDM), green color code.
- Prelubricated (Grade "A" EPDMA)

(See Data Sheet TFP1895 for aid in selecting proper gasket)

Ordering Procedure

When placing an order, indicate the full product name. Please specify the quantity, figure number, type of gasket, Grade "A" EPDMA, Prelubricated (Grade "A" EPDMA) or Grade "E" EPDM Tri-Seal, and size.

Grinnell Grooved Piping Products, valves, accessories and other products are available throughout the U.S., Canada, and internationally, through a network of distribution centers. You may write directly or call 215-362-0700 for the distributor nearest you.

Care and Maintenance

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in accordance with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any authority having jurisdiction. The installing contractor or product manufacturer should be contacted relative to any questions. Any impairment must be immediately corrected.

It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service.

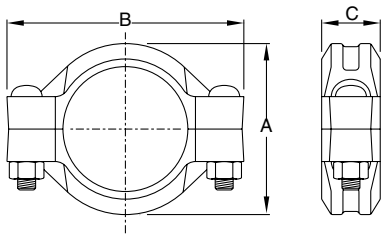
Limited Warranty

Products manufactured by Tyco Fire Products are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by Tyco Fire Products. No warranty is given for products or components manufactured by companies not affiliated by ownership with Tyco Fire Products or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association (NFPA), and/or the standards of any other Authorities Having Jurisdiction. Materials found by Tyco Fire Products to be defective shall be either repaired or replaced, at Tyco Fire Products' sole option. Tyco Fire Products neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. Tyco Fire Products shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

IN NO EVENT SHALL TYCO FIRE PRODUCTS BE LIABLE, IN CONTRACT, TORT, STRICT LIABILITY OR UNDER ANY OTHER LEGAL THEORY, FOR INCIDENTAL, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LABOR CHARGES, REGARDLESS OF WHETHER TYCO FIRE PRODUCTS WAS INFORMED ABOUT THE POSSIBILITY OF SUCH DAMAGES, AND IN NO EVENT SHALL TYCO FIRE PRODUCTS' LIABILITY EXCEED AN AMOUNT EQUAL TO THE SALES PRICE.

THE FOREGOING WARRANTY IS MADE IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Figure 707 Grooved Coupling



Pipe		Max. *‡	Max.†	Max.†	Nominal Dimensions			Deflection‡		Bolt	Net
Size	O.D. Inches *mm*	End Gap Inches *mm*	Pressure psi *kPa*	End Load Lbs. *N*	A Inches *mm*	B Inches *mm*	C Inches *mm*	°Per Coupling	Inches/ Foot *mm/m*	Size** Dia. x Lg.	Wt. Lbs. *Kg.*
1½"	1.900 *48.3*	0.13 *3.3*	500 *3,447*	1,418 *6,308*	2.97 *75.4*	4.63 *117.6*	1.81 *46.0*	3° - 46'	0.79 *65.8*	½" x 3" *M12 x 76*	2.5 *1.1*
2"	2.375 *60.3*	0.13 *3.3*	500 *3,447*	2,215 *9,853*	3.54 *89.9*	5.25 *133.4*	1.88 *47.8*	3° - 1'	0.63 *52.5*	½" x 3" *M12 x 76*	3.0 *1.4*
2½"	2.875 *73.0*	0.13 *3.3*	500 *3,447*	3,246 *14,439*	4.06 *103.1*	5.75 *146.1*	1.88 *47.8*	2° - 29'	0.52 *43.3*	½" x 3" *M12 x 76*	3.5 *1.6*
76.1mm	3.000 *76.1*	0.13 *3.3*	300 *2,068*	2,121 *9,435*	4.19 *106.4*	5.75 *146.1*	1.88 *47.8*	2° - 23'	0.50 *41.7*	M12 x 76	3.7 *1.7*
3"	3.500 *88.9*	0.13 *3.3*	500 *3,447*	4,811 *21,400*	4.69 *119.1*	6.38 *162.1*	1.88 *47.8*	2° - 3'	0.43 *35.8*	½" x 3" *M12 x 76*	4.0 *1.8*
4"	4.500 *114.3*	0.25 *6.4*	500 *3,447*	7,952 *35,372*	5.95 *151.1*	8.25 *209.6*	2.06 *52.3*	3° - 11'	0.67 *55.8*	⅝" x 3¼" *M16 x 83*	7.0 *3.2*
5"	5.563 *141.3*	0.25 *6.4*	500 *3,447*	12,153 *54,059*	7.08 *179.8*	10.00 *254.0*	2.06 *52.3*	2° - 35'	0.54 *45.0*	¾" x 4¾" *M20 x 121*	10.5 *4.8*
165.1mm	6.500 *165.1*	0.25 *6.4*	300 *2,068*	9,955 *44,282*	8.19 *208.0*	11.25 *285.8*	2.06 *52.3*	2° - 12'	0.46 *38.3*	M20 x 121	12.5 *5.7*
6"	6.625 *168.3*	0.25 *6.4*	500 *3,447*	17,236 *76,670*	8.30 *210.8*	11.25 *285.8*	2.06 *52.3*	2° - 10'	0.45 *37.5*	¾" x 4¾" *M20 x 121*	12.5 *5.7*
8"	8.625 *219.1*	0.25 *6.4*	500 *3,447*	29,213 *129,946*	10.68 *271.3*	14.00 *355.6*	2.47 *62.7*	1° - 40'	0.35 *29.2*	⅞" x 6½" *M22 x 165*	23.5 *10.7*
10"	10.750 *273.0*	0.25 *6.4*	500 *3,447*	45,381 *201,864*	13.06 *331.7*	16.44 *417.6*	2.63 *66.8*	1° - 20'	0.28 *23.3*	1" x 6½" *M24 x 165*	33.0 *15.0*
12"	12.750 *323.9*	0.25 *6.4*	500 *3,447*	63,838 *283,966*	15.39 *390.9*	18.84 *478.5*	2.63 *66.8*	1° - 7'	0.23 *19.2*	1" x 6½" *M24 x 165*	37.0 *16.8*

* Maximum available gap between pipe ends. Minimum gap = 0.

† Maximum pressure and end load are total from all loads based on standard weight steel pipe. Pressure ratings and end loads may differ on other pipe materials and/or wall thickness. Contact Tyco Fire Products for details. See Fire Protection Equipment Submittal Sheet for Listing and Approval pressure ratings.

** Gold color coded metric bolt sizes are available upon request

‡ Max End Gap and Deflection is for cut grooved standard weight pipe. Values for roll grooved pipe will be ½ that of cut grooved.

General Notes: It is the Designer's responsibility to select products suitable for the intended service and to ensure that pressure ratings and performance data is not exceeded. Always read and understand the installation instructions (IH-1000). Never remove any piping component or correct or modify any piping deficiencies without first depressurizing and draining the system. Material and gasket selection should be verified to be compatible for the specific application.

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Grinnell Grooved Fire Protection Products
Figure 71
Flange Adapter

General Description

See Fire Protection Submittal Sheet for Pressure Rating and Listing/Approval Information

The 71 Flange Adapter allows a direct transition from flanged components into a grooved piping system. Flange bolt patterns conform to ANSI Class 125 and 150 standards and PN16 as indicated.

WARNING

The Figure 71 Flange Adapter described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. ***Failure to do so may impair the performance of this device.*** *The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.*

Technical Data

Figure: 71
Sizes: 2" - 12"
Approvals: UL, FM, ULC, VdS, and LPCB; See Fire Protection Submittal Sheet for exact Listing / Approval information.
Housing: Ductile iron conforming to ASTM A-536, Grade 65-45-12
Protective Coatings:
- Non-lead orange paint
- Fire brigade red (optional) non-lead paint
- Hot dipped galvanized conforming to ASTM A-153

Gasket: (specify when ordering)
- Grade "E" EPDM, green color code.

(See Data Sheet TFP1895 for aid in selecting proper gasket)

Ordering Procedure

When placing an order, indicate the full product name. Please specify the quantity, figure number, type of gasket, Grade "E" EPDM, and size.
Grinnell Grooved Piping Products, valves, accessories and other products are available throughout the U.S., Canada, and internationally, through a network of distribution centers. You may write directly or call 215-362-0700 for the distributor nearest you.

Care and Maintenance

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in accordance with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any authority having jurisdiction. The installing contractor or product manufacturer should be contacted relative to any questions. Any impairment must be immediately corrected. It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service.

Limited Warranty

Products manufactured by Tyco Fire Products are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by Tyco Fire Products. No warranty is given for products or components manufactured by companies not affiliated by ownership with Tyco Fire Products or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association (NFPA), and/or the standards of any other Authorities Having Jurisdiction. Materials found by Tyco Fire Products to be defective shall be either repaired or replaced, at Tyco Fire Products' sole option. Tyco Fire Products neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. Tyco Fire Products shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.
IN NO EVENT SHALL TYCO FIRE PRODUCTS BE LIABLE, IN CONTRACT, TORT, STRICT LIABILITY OR UNDER ANY OTHER LEGAL THEORY, FOR INCIDENTAL, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LABOR CHARGES, REGARDLESS OF WHETHER TYCO FIRE PRODUCTS WAS INFORMED ABOUT THE POSSIBILITY OF SUCH DAMAGES, AND IN NO EVENT SHALL TYCO FIRE PRODUCTS' LIABILITY EXCEED AN AMOUNT EQUAL TO THE SALES PRICE.
THE FOREGOING WARRANTY IS MADE IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Figure 71 Flange Adapter

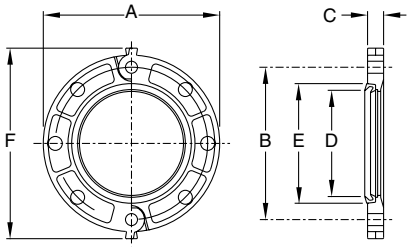


Figure 71 ANSI Calss 125 and 150

Pipe		Max †	Max †	Nominal Dimensions						Bolts ‡		Net
Nominal Size Inches	O.D. Inches *mm*	Pressure psi *kPa*	End Load Lbs. *N*	A Inches *mm*	B Inches *mm*	C Inches *mm*	*D Inches *mm*	*E Inches *mm*	F Inches *mm*	Size Dia. x Lg.	Qty.	Wt. lbs. *kg*
2	2.375 *60.3*	250 *1,724*	1,107 *4,924*	6.38 *162.1*	4.75 *120.7*	0.75 *19.1*	2.38 *60.5*	3.41 *86.6*	7.25 *184.2*	5/8" x 3"	4	3.0 *1.4*
2 1/2	2.875 *73.0*	250 *1,724*	1,622 *7,215*	7.00 *178.0*	5.50 *140.0*	0.88 *22.0*	2.88 *73.0*	3.91 *99.0*	7.88 *200.0*	5/8" x 3"	4	5.0 *2.3*
3	3.500 *88.9*	250 *1,724*	2,404 *10,693*	7.50 *190.5*	6.00 *152.4*	0.94 *23.9*	3.50 *88.9*	4.53 *115.1*	9.88 *251.0*	5/8" x 3"	4	5.6 *2.5*
4	4.500 *114.3*	250 *1,724*	3,974 *17,676*	9.00 *228.6*	7.50 *190.5*	0.94 *23.9*	4.50 *114.3*	5.53 *140.5*	9.90 *251.5*	5/8" x 3"	8	7.0 *3.2*
5	5.563 *141.3*	250 *1,724*	6,073 *27,013*	10.00 *254.0*	8.50 *215.9*	1.00 *25.4*	5.56 *141.2*	6.72 *170.7*	11.38 *289.1*	3/4" x 3 1/2"	8	9.2 *4.2*
6	6.625 *168.3*	250 *1,724*	8,614 *38,315*	11.00 *279.4*	9.50 *241.3*	1.00 *25.4*	6.62 *168.1*	7.78 *197.6*	11.88 *301.8*	3/4" x 3 1/2"	8	10.0 *4.5*
8	8.625 *219.1*	250 *1,724*	14,599 *64,936*	13.50 *342.9*	11.75 *298.5*	1.13 *28.7*	8.62 *218.9*	9.94 *252.5*	14.38 *365.3*	3/4" x 3 1/2"	8	16.6 *7.5*
10	10.750 *273.0*	250 *1,724*	22,679 *100,876*	16.00 *406.4*	14.25 *362.0*	1.19 *30.2*	10.75 *273.1*	12.31 *312.7*	16.88 *428.8*	7/8" x 4"	12	21.8 *9.9*
12	12.750 *323.9*	250 *1,724*	31,903 *141,905*	19.00 *482.6*	17.00 *431.8*	1.25 *31.8*	12.75 *323.9*	14.31 *363.5*	20.00 *508.0*	7/8" x 4"	12	24.2 *11.0*

Figure 71 PN16

Pipe		Max †	Max †	Nominal Dimensions						Bolts ‡		Net
Nom.Size Inches *mm*	O.D. *mm*	Pressure *Bar*	End Load Lbs. *N*	A Inches *mm*	B Inches *mm*	C Inches *mm*	*D Inches *mm*	*E Inches *mm*	F Inches *mm*	Size Dia. x Lg.	Qty.	Wt. lbs. *kg*
2" *50*	60.3	16	1,028 *4,573*	6.38 *162.1*	4.92 *125.0*	0.75 *19.1*	2.38 *60.5*	3.41 *86.6*	7.25 *184.2*	M16 x 76	4	3.0 *1.4*
2 1/2" *65*	76.1	16	1,640 *7,295*	7.28 *184.9*	5.71 *145.0*	0.88 *22.4*	3.00 *76.1*	4.03 *102.4*	8.09 *205.5*	M16 x 76	4	5.6 *2.5*
3" *80*	88.9	16	2,232 *9,928*	7.88 *200.2*	6.30 *160.0*	0.94 *23.9*	3.50 *88.9*	4.53 *115.1*	8.75 *222.3*	M16 x 76	8	6.6 *3.0*
4" *100*	114.3	16	3,690 *16,413*	9.00 *228.6*	7.09 *180.1*	0.94 *23.9*	4.50 *114.3*	5.53 *140.5*	9.90 *251.5*	M16 x 76	8	7.0 *3.2*
5" *125*	139.7	16	5,512 *24,517*	9.84 *249.9*	8.27 *210.1*	1.00 *25.4*	5.50 *139.7*	6.53 *165.9*	10.69 *271.5*	M16 x 89	8	9.2 *4.2*
6" *150*	165.1	16	7,698 *34,241*	11.25 *285.8*	9.45 *240.0*	1.00 *25.4*	6.50 *165.1*	7.53 *191.3*	12.12 *307.8*	M20 x 89	8	10.0 *4.5*
6" *150*	168.3	16	7,997 *35,571*	11.00 *279.4*	9.49 *241.1*	1.00 *25.4*	6.62 *168.1*	7.78 *197.6*	11.88 *301.8*	M20 x 89	8	10.0 *4.5*
8" *200*	219.1	16	13,555 *60,293*	13.38 *339.9*	11.61 *294.9*	1.13 *28.7*	8.62 *218.9*	9.94 *252.5*	14.31 *363.5*	M20 x 89	12	16.6 *7.5*
10 *273.0*	273.0	16	21,057 *93,662*	16.00 *406.4*	13.98 *355.1*	1.19 *30.2*	10.75 *273.1*	12.31 *312.7*	16.88 *428.8*	M22 x 102	12	21.8 *9.9*
12" *300*	323.9	16	29,621 *131,754*	18.12 *460.2*	16.14 *410.0*	1.25 *31.8*	12.75 *323.9*	14.31 *363.9*	19.19 *487.4*	M24 x 102	12	28.0 *12.7*

† Maximum pressure and end load are total from all loads based on standard weight steel pipe. Pressure ratings and end loads may differ on other pipe materials and/or wall thickness. Contact Tyco Fire Products for details. See Fire Protection Equipment Submittal Sheet for Listing and Approval pressure ratings.

* Dimensions D and E represent minimum and maximum sealing surfaces.

‡ Bolts and Nuts are not supplied. Bolt lengths are standard; it is the responsibility of the purchaser to verify correct length for the intended application.

General Notes: It is the Designer's responsibility to select products suitable for the intended service and to ensure that pressure ratings and performance data is not exceeded. Always read and understand the installation instructions (IH-1000). Never remove any piping component or correct or modify any piping deficiencies without first depressurizing and draining the system. Material and gasket selection should be verified to be compatible for the specific application.

ISO 9001 Certified Company

WELD-MISER™ TEE-LET® Welded Outlet Fittings

ANVILSTAR™
Fire Products Division of Anvil® International

MERIT®

For Fire Protection & Other Low Pressure Piping Systems

Submittal Sheet

Merit Weld-Miser™ Tee-Let® Welding Branch Outlet Fittings offer the user a high strength, low cost forged threaded and grooved line of fittings specifically designed and manufactured to be installed on Schedules 5 thru 10, proprietary thin wall flow pipe and standard wall pipe.

Merit Tee-Lets are forged steel welding outlet fittings. The material used in manufacture meets the chemical and physical requirements of ASTM A 53, Grades A or B, Type E, A-135, A-795, Tee-Lets employ a low weld volume design to provide for either a partial or full penetration weld employing a single pass with minimum burn-through and pipe distortion. Weld Miser Tee-Lets are recommended for use on proprietary thin wall, Schedules 5, 10 and 40 pipe. Threads comply with ANSI B1.20.1 or ISO7/1. They are UL Listed and FM Approved for use conforming to the requirements of Bulletin 13 1999 of the National Fire Protection Association. When used in fire sprinkler systems, Tee-Lets are rated for 300 psi. When used in mechanical systems, maximum pressures are calculated using criteria developed for ASME B31 piping code.

UL FM ULC
APPROVED
For Listing / Approval details contact your AnvilStar™ Representative.

TEE-LET WELDED OUTLET FITTING
(UL VIZU — EX6032, FM Approval Guide Chapter 1 – Pipe Fittings)

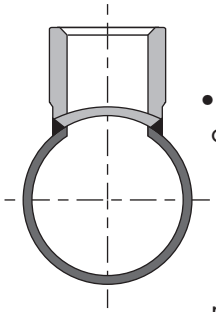
Outlet Model	Outlet Pipe Size	Header Pipe Size	Rated Pressure
	In.	*In.*	*psig*
Tee-Let Type A (F-Threaded End)	½, ¾, 1	½ - 8 (Sch.10, 40)	300
	1¼, 1½, 2, 2½, 3, 4	½ - 4 (Sch. 5, DynaFlow)	
	2	4 (EZ-Flow)	
	2, 4	6 (EZ-Flow)	
Tee-Let Type C (Grooved End)	1¼ - 8	1¼ - 8 (Sch.10, 40)	300
	2½ - 8	½ - 4 (Sch. 5, DynaFlow)	
Tee-Let Type C/R (Roll Grooved End)	1¼ - 6	1¼ - 8 (All Schedules)	300

PROJECT INFORMATION:		APPROVAL STAMP:
Project:		
Date:	**Phone:**	
Architect / Engineer:		
Contractor:		
Address:		
Notes 1:		
Notes 2:		

For the latest UL/ULC Listed and FM Approved pressure ratings, versus pipe schedule, go to **www.anvilstar.com** or contact your local AnvilStar representative

ANVIL INTERNATIONAL, INC.

MERIT®



UNIFIED DESIGN™ SERIES

Merit's Unified Design Series carries all important design considerations into its entire line of welding branch outlet fittings.

Merit® Weld-Miser™ Tee-Lets® are designed and Manufactured to reduce the amount of weld required to install the Tee-Lets on thin wall or proprietary flow pipe. Typically only one weld-pass completes the installation. Merit Tee-Lets install with less weld volume than any other brand of welding outlet fittings for fire sprinkler applications. To accomplish this:

- The contoured end of the fittings employs a reduced outside diameter. Two major advantages are immediately apparent:
- The thinner wall on the contoured end permits welding temperatures to be matched to the thickness of the branch line or main thereby insuring complete penetration without cold welds, weld roll-off, burn-through or excessive distortion.
- On smaller sizes a heavier section is maintained on the threaded end of the fitting. This protects the threads from damage during shipping and handling prior to installation as well as from weld distortion.
- Each outlet size 1½" and larger, whether male or female threaded, cut grooved or beveled requires the same hole size in the header pipe. This simplifies the installation process.

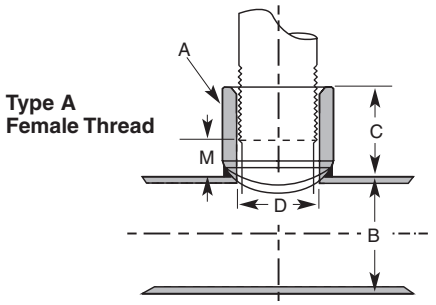
GENERAL SPECIFICATIONS

- Tee-Let welding outlet fittings are manufactured from highly weldable steel which conforms to the chemical and physical requirements of ASTM A-53, Grades A or B, Type E. Ease of installation is assured when automatic welding equipment is used to install Merit Tee-Lets.
- Threads are cut in accordance with the requirements of ANSI B1.20.1, national standard for tapered pipe threads, or ISO-7-1 threads are available.
- Tee-Let threaded and grooved welding outlet fittings are UL/ULC Listed and FM Approved for use in the fire sprinkler systems installed in accordance with the requirements of NFPA Bulletin 13. They are rated for 300 PSI operation in fire sprinkler systems, and higher pressures in other non-critical piping systems.
- Tee-Lets are offered in a wide variety of header sizes. The consolidated header sizes shown in the following charts allow the fittings to be installed on more than one header size, permitting the first size listed to fit the header perfectly, while a small gap along the longitudinal center line of the header will appear for the second size listed.
- Merit® Weld-Miser™ Tee-Lets® are identified by a lot number that provides full traceability per ISO 9000 specifications.

FOR YOUR PIPING SYSTEMS SPECIFY WELD-MISER™ TEE-LET®

Branch Outlet Fittings shall be Merit Weld-Miser Tee-Let, Lightweight forged steel, employing low weld volume profile to provide for full penetration welds with minimum burn through and pipe distortion on Schedule 5 thru 10, proprietary thin wall, and standard wall pipe. Threads are to be ANSI B1.20.1, or ISO-7-1, and the bore of the fittings calculated to improve flow. Welding outlets to be UL Listed, FM Approved for use conforming to NFPA, Bulletin 13 and pressure rated for 300 PSI maximum.

MERIT®



WELD-MISER™ TEE-LET® DIMENSIONS & PART NUMBERS

Part Number	Nominal Outlet A	Nominal Header B	Outlet Length C	Inside Diameter D	Make Up M	Weight Each
NPT (BSPT)	*In (mm)*	*In (mm)*	*In (mm)*	*In (mm)*	*In (mm)*	*Lb. (kg)*
1002002	¼ x	1¼ - 8				0.080
–	*6 x*	*6 - 200*				*0.04*
1005012		1¼ - 1½	1.063	0.700	0.500	0.171
–		*32 - 40*	*27.0*	*17.8*	*12.7*	*0.08*
1005015	½ x	1½ - 2	1.063	0.700	0.500	0.171
–	*13 x*	*40 - 50*	*27.0*	*17.8*	*12.7*	*0.08*
1005020		2 - 2½	1.063	0.700	0.500	0.171
–		*50 - 65*	*27.0*	*17.8*	*12.7*	*0.08*
1005025		2½ - 8	1.063	0.700	0.500	0.169
–		*65 - 200*	*27.0*	*17.8*	*12.7*	*0.08*
1007012		1¼ - 1½	1.125	0.900	0.500	0.260
–		*32 - 40*	*28.6*	*22.9*	*12.7*	*0.12*
1007015	¾ x	1½ - 2	1.125	0.900	0.500	0.260
–	*19 x*	*40 - 50*	*28.6*	*22.9*	*12.7*	*0.12*
1007020		2 - 2½	1.125	0.900	0.500	0.260
–		*50 - 65*	*28.6*	*22.9*	*12.7*	*0.12*
1007025		2½ - 8	1.125	0.900	0.500	0.256
–		*65 - 200*	*28.6*	*22.9*	*12.7*	*0.12*
1010012		1¼ - 1½	1.250	1.145	0.500	0.331
1110012		*32 - 40*	*31.8*	*29.1*	*12.7*	*0.15*
1010015		1½ - 2	1.250	1.145	0.500	0.331
1110015		*40 - 50*	*31.8*	*29.1*	*12.7*	*0.15*
1010020		2 - 2½	1.250	1.145	0.500	0.320
1110020	1 x	*50 - 65*	*31.8*	*29.1*	*12.7*	*0.15*
1010025	*25 x*	2½ - 3	1.250	1.145	0.500	0.314
1110025		*65 - 80*	*31.8*	*29.1*	*12.7*	*0.14*
1010030		3 - 4	1.250	1.145	0.500	0.309
1110030		*80 - 100*	*31.8*	*29.1*	*12.7*	*0.14*
1010050		5 - 8	1.250	1.145	0.500	0.291
1110050		*125 - 200*	*31.8*	*29.1*	*12.7*	*0.13*
1012012		1¼ - 1½	1.375	1.490	0.500	0.432
1112012		*32 - 40*	*34.9*	*37.8*	*12.7*	*.019*
1012015		1½ - 2	1.375	1.490	0.500	0.421
1112015		*40 - 50*	*34.9*	*37.8*	*12.7*	*.019*
1012020		2 - 2½	1.375	1.490	0.500	0.421
1112020	1¼ x	*50 - 65*	*34.9*	*37.8*	*12.7*	*.019*
1012025	*32 x*	2½ - 3	1.375	1.490	0.500	0.411
1112025		*65 - 80*	*34.9*	*37.8*	*12.7*	*.019*
1012030		3 - 4	1.375	1.490	0.500	0.389
1112030		*80 - 100*	*34.9*	*37.8*	*12.7*	*.018*
1012050		5 - 8	1.375	1.490	0.500	0.389
1112050		*125 - 200*	*34.9*	*37.8*	*12.7*	*.018*
1015015		1½	1.625	1.610	0.875	0.477
1115015		40	41.3	40.9	22.2	.022
1015020		2	1.625	1.610	0.875	0.477
1115020		*50*	*41.3*	*40.9*	*22.2*	*.022*
1015025		2½	1.625	1.610	0.875	0.477
1115025	1½ x	*65*	*41.3*	*40.9*	*22.2*	*.022*
1015030	40 x	3 - 4	1.625	1.610	0.875	0.477
1115030		*80 - 100*	*41.3*	*40.9*	*22.2*	*.022*
1015040		4	1.625	1.610	0.875	0.477
1115040		*100*	*41.3*	*40.9*	*22.2*	*.022*
1015050		5 - 8	1.625	1.610	0.875	0.477
1115050		*125 - 200*	*41.3*	*40.9*	*22.2*	*.022*

WELD-MISER™ TEE-LET® DIMENSIONS & PART NUMBERS

Part Number	Nominal Outlet A	Nominal Header B	Outlet Length C	Inside Diameter D	Make Up M	Weight Each
NPT (BSPT)	*In (mm)*	*In (mm)*	*In (mm)*	*In (mm)*	*In (mm)*	*Lb. (kg)*
1020020		2	1.750	2.067	0.875	0.857
1120020		*50*	*44.5*	*52.5*	*22.2*	*0.38*
1020025		2½	1.750	2.067	0.875	0.829
1120025		*65*	*44.5*	*52.5*	*22.2*	*0.38*
1020030		3	1.750	2.067	0.875	0.829
1120030		*80*	*44.5*	*52.5*	*22.2*	*0.39*
1020040	2 x	4	1.750	2.067	0.875	0.800
1120040	*50 x*	*100*	*44.5*	*52.5*	*22.2*	*0.36*
1020050		5	1.750	2.067	0.875	0.743
1120050		*125*	*44.5*	*52.5*	*22.2*	*0.34*
1020060		6	1.750	2.067	0.875	0.743
1120060		*150*	*44.5*	*52.5*	*22.2*	*0.34*
1020080		8	1.750	2.067	0.875	0.743
1120080		*200*	*44.5*	*52.5*	*22.2*	*0.34*
1025025		2½	2.215	2.469	1.125	1.250
1125025		*65*	*54.0*	*62.7*	*28.6*	*0.55*
1025030		3	2.215	2.469	1.125	1.200
1125030		*80*	*54.0*	*62.7*	*28.6*	*0.55*
1025040		4	2.215	2.469	1.125	1.150
1125040	2½ x	*100*	*54.0*	*62.7*	*28.6*	*0.52*
1025050	*65 x*	5	2.215	2.469	1.125	1.150
1125050		*125*	*54.0*	*62.7*	*28.6*	*0.52*
1025060		6	2.215	2.469	1.125	1.150
1125060		*150*	*54.0*	*62.7*	*28.6*	*0.52*
1025080		8	2.215	2.469	1.125	1.150
1125080		*200*	*54.0*	*62.7*	*28.6*	*0.52*
1030030		3	2.500	3.068	1.500	1.750
–		*80*	*63.5*	*77.9*	*38.1*	*0.79*
1030040		4	2.500	3.068	1.500	1.700
–		*100*	*63.5*	*77.9*	*38.1*	*0.77*
1030050	3 x	5	2.500	3.068	1.500	1.700
–	*80 x*	*125*	*63.5*	*77.9*	*38.1*	*0.77*
1030060		6	2.500	3.068	1.500	1.650
–		*150*	*63.5*	*77.9*	*38.1*	*0.75*
1030080		8	2.500	3.068	1.500	1.650
–		*200*	*63.5*	*77.9*	*38.1*	*0.75*
1040040		4	3.000	4.026	2.000	3.000
–		*100*	*76.2*	*102.3*	*50.8*	*1.36*
1040050		5	3.000	4.026	2.000	2.900
–	4 x	*125*	*76.2*	*102.3*	*50.8*	*1.32*
1040060	*100 x*	6	3.000	4.026	2.000	2.800
–		*150*	*76.2*	*102.3*	*50.8*	*1.27*
1040080		8	3.000	4.026	2.000	2.800
–		*200*	*76.2*	*102.3*	*50.8*	*1.27*

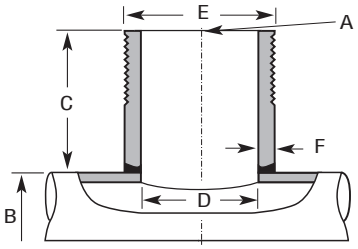
NOTE: Part #1002002 is not UL Listed or FM Approved.
All size-on-size (i.e. 2 x 2) Tee-Lets are not FM Approved.

For the latest UL/ULC Listed and FM Approved pressure ratings, versus pipe schedule, go to **www.anvilstar.com** or contact your local AnvilStar representative

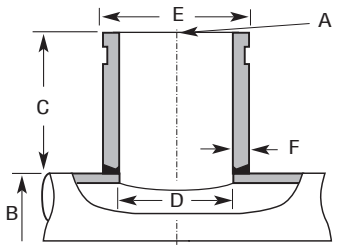
ANVIL INTERNATIONAL, INC.

MERIT®

Type B
Male Thread
Standard Weight



Type C
Cut Groove
Standard Weight



WELD-MISER™ TEE-LET® - DIMENSIONS (NOMINAL SIZES 1" THRU 2")

Male Thread Std. Wt.	Cut Groove Std. Wt.	Nominal Outlet A	Nominal Header B	Outlet Length C	Inside Diameter D	Outside Diameter E	Wall Thickness F
NPT (BSPT)	*NPT (BSPT)*	*In.(mm)*	*In.(mm)*	*In.(mm)*	*In.(mm)*	*In.(mm)*	*In.(mm)*
1310012	2010012	1 x *25 x*	1¼ - 1½ *32 - 40*	3 *80*	1.049 *26.6*	1.315 *33.4*	0.133 *3.4*
1310015	2010015		1½ - 2 *40 - 50*	3 *80*	1.049 *26.6*	1.315 *33.4*	0.133 *3.4*
1310020	2010020		2 - 2½ *50 - 65*	3 *80*	1.049 *26.6*	1.315 *33.4*	0.133 *3.4*
1310025	2010025		2½ - 4 *65 - 100*	3 *80*	1.049 *26.6*	1.315 *33.4*	0.133 *3.4*
1310050	2010050		5 - 8 *125 - 200*	3 *80*	1.049 *26.6*	1.315 *33.4*	0.133 *3.4*
1312012	2012012	1¼ x *32 x*	1¼ *32*	3 *80*	1.368 *34.7*	1.660 *42.2*	0.140 *3.6*
1312015	2012015		1½ *40*	3 *80*	1.368 *34.7*	1.660 *42.2*	0.140 *3.6*
1312020	2012020		2 - 2½ *50 - 65*	3 *80*	1.368 *34.7*	1.660 *42.2*	0.140 *3.6*
1312025	2012025		3 - 4 *80 - 100*	3 *80*	1.368 *34.7*	1.660 *42.2*	0.140 *3.6*
1312050	2012050		5 - 8 *125 - 200*	3 *80*	1.368 *34.7*	1.660 *42.2*	0.140 *3.6*
1315015	2015015	1½ x *40 x*	1½ *40*	3 *80*	1.610 *40.9*	1.900 *48.3*	0.145 *3.7*
1315020	2015020		2 *50*	3 *80*	1.610 *40.9*	1.900 *48.3*	0.145 *3.7*
1315025	2015025		2½ *65*	3 *80*	1.610 *40.9*	1.900 *48.3*	0.145 *3.7*
1315030	2015030		3 - 4 *80 - 100*	3 *80*	1.610 *40.9*	1.900 *48.3*	0.145 *3.7*
1315050	2015050		5 - 8 *125 - 200*	3 *80*	1.610 *40.9*	1.900 *48.3*	0.145 *3.7*
1320020	2020020	2 x *50 x*	2 *50*	3 *80*	2.067 *52.5*	2.375 *60.3*	0.154 *3.9*
1320025	2020025		2½ *65*	3 *80*	2.067 *52.5*	2.375 *60.3*	0.154 *3.9*
1320030	2020030		3 *80*	3 *80*	2.067 *52.5*	2.375 *60.3*	0.154 *3.9*
1320035	2020035		4 *100*	3 *80*	2.067 *52.5*	2.375 *60.3*	0.154 *3.9*
1320050	2020050		5 *125*	3 *80*	2.067 *52.5*	2.375 *60.3*	0.154 *3.9*
1320060	2020060		6 *150*	3 *80*	2.067 *52.5*	2.375 *60.3*	0.154 *3.9*
1320080	2020080		8 *200*	3 *80*	2.067 *52.5*	2.375 *60.3*	0.154 *3.9*

NOTE: Tee-Lets are manufactured to fit size-on-size, that is the contoured shape on a given Tee-Let is made to fit perfectly on the first listed header size. If installed on the second header size marked on the fitting, a slight gap of approximately 1/32" will appear along the longitudinal centerline of the header. For example, a 1" x 2 - 2½" Tee-Let, is a 1" outlet fitting manufactured to fit perfectly on the 2" header size listed, while leaving a 1/32" gap along the longitudinal centerline of the 2½" size. If a perfect fit is required for a 2½" header pipe, then a 1" x 2½ - 3" Tee-Let would be ordered. Size consolidations are employed to reduce inventory and provide for greater flexibility.

For the latest UL/ULC Listed and FM Approved pressure ratings, versus pipe schedule, go to **www.anvilstar.com** or contact your local AnvilStar representative

ANVIL INTERNATIONAL, INC.

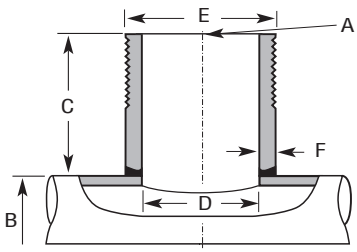
WELD-MISER™ TEE-LET® Welded Outlet Fittings

ANVILSTAR™
Fire Products Division of Anvil® International

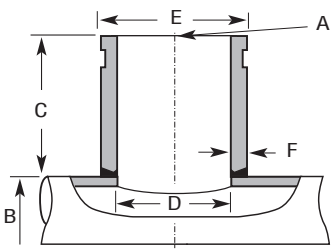
Submittal Sheet

MERIT®

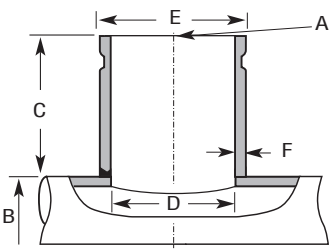
Type B
Male Thread
Standard Weight



Type C
Cut Groove
Standard Weight



Type C/R
Roll Groove
Schedule 10



WELD-MISER™ TEE-LET® - DIMENSIONS (NOMINAL SIZES 2½" THRU 8")

Male Thread Std. Wt.	Cut Groove Std. Wt.	Roll Groove Sch. 10	Nominal Outlet A	Nominal Header B	Outlet Length C	Inside Diameter - D		Outside Diameter E	Wall Thickness - F	
						Standard Weight	Schedule 10		Standard Weight	Schedule 10
NPT (ISO-7-1)	*NPT (ISO-7-1)*	*NPT (ISO-7-1)*	*In.(mm)*	*In.(mm)*	*In.(mm)*	*In.(mm)*	*In.(mm)*	*In.(mm)*	*In.(mm)*	*In.(mm)*
1325025	2025025	2225025	2½ x *65 x*	2½ *65*	3 *80*	2.469 *62.7*	2.635 *67.0*	2.875 *76.2*	0.203 *5.0*	0.120 *3.0*
	2125025									
1325030	2025030	2225030		3 *80*	3 *80*	2.469 *62.7*	2.635 *67.0*	2.875 *76.2*	0.203 *5.0*	0.120 *3.0*
	2125030									
1325035	2025035	2225035		4 *100*	3 *80*	2.469 *62.7*	2.635 *67.0*	2.875 *76.2*	0.203 *5.0*	0.120 *3.0*
	2125035									
1325050	2025050	2225050		5 *125*	3 *80*	2.469 *62.7*	2.635 *67.0*	2.875 *76.2*	0.203 *5.0*	0.120 *3.0*
	2125050									
1325060	2025060	2225060		6 *175*	3 *80*	2.469 *62.7*	2.635 *67.0*	2.875 *76.2*	0.203 *5.0*	0.120 *3.0*
	2125060									
1325080	2025080	2225080		8 *200*	3 *80*	2.469 *62.7*	2.635 *67.0*	2.875 *76.2*	0.203 *5.0*	0.120 *3.0*
	2125080									
1330030	2030030	2230030	3 x *80 x*	3 *80*	3 *80*	3.068 *78.0*	3.260 *83.0*	3.500 *88.0*	0.216 *5.0*	0.120 *3.0*
1330035	2030035	2230035		3½ *85*	3 *80*	3.068 *78.0*	3.260 *83.0*	3.500 *88.0*	0.216 *5.0*	0.120 *3.0*
1330040	2030040	2230040		4 *100*	3 *80*	3.068 *78.0*	3.260 *83.0*	3.500 *88.0*	0.216 *5.0*	0.120 *3.0*
1330050	2030050	2230050		5 *125*	3 *80*	3.068 *78.0*	3.260 *83.0*	3.500 *88.0*	0.216 *5.0*	0.120 *3.0*
1330060	2030060	2230060		6 *150*	3 *80*	3.068 *78.0*	3.260 *83.0*	3.500 *88.0*	0.216 *5.0*	0.120 *3.0*
1330080	2030080	2230080		8 *200*	3 *80*	3.068 *78.0*	3.260 *83.0*	3.500 *88.0*	0.216 *5.0*	0.120 *3.0*
1340040	2040040	2240040	4 x *100 x*	4 *100*	4 *100*	4.026 *102.0*	4.260 *108.0*	4.500 *114.0*	0.237 *6.0*	0.120 *3.0*
1340050	2040050	2240050		5 *125*	4 *100*	4.026 *102.0*	4.260 *108.0*	4.500 *114.0*	0.237 *6.0*	0.120 *3.0*
1340060	2040060	2240060		6 *150*	4 *100*	4.026 *102.0*	4.260 *108.0*	4.500 *114.0*	0.237 *6.0*	0.120 *3.0*
1340080	2040080	2240080		8 *200*	4 *100*	4.026 *102.0*	4.260 *108.0*	4.500 *114.0*	0.237 *6.0*	0.120 *3.0*
–	2060060	2260060	6 x *150 x*	6 *150*	4 *100*	6.065 *155.0*	6.357 *161.5*	6.625 *168.3*	0.280 *7.1*	0.134 *3.0*
–	2060080	2260080		8 *200*	4 *100*	6.065 *155.0*	6.357 *161.5*	6.625 *168.3*	0.280 *7.1*	0.134 *3.0*
–	2080080	–	8 x *200 x*	8 *200*	4 *100*	7.981 *203.0*	8.329 *212.0*	8.625 *213.0*	0.322 *8.0*	0.148 *3.0*

NOTE: Tee-Lets are manufactured to fit size-on-size, that is the contoured shape on a given Tee-Let is made to fit perfectly on the first listed header size. If installed on the second header size marked on the fitting, a slight gap of approximately 1/32" will appear along the longitudinal centerline of the header. For example, a 1" x 2 - 2½" Tee-Let, is a 1" outlet fitting manufactured to fit perfectly on the 2" header size listed, while leaving a 1/32" gap along the longitudinal centerline of the 2½" size. If a perfect fit is required for a 2½" header pipe, then a 1" x 2½ - 3" Tee-Let would be ordered. Size consolidations are employed to reduce inventory and provide for greater flexibility.

For the latest UL/ULC Listed and FM Approved pressure ratings, versus pipe schedule, go to **www.anvilstar.com** or contact your local AnvilStar representative

ANVIL INTERNATIONAL, INC.

CROSS

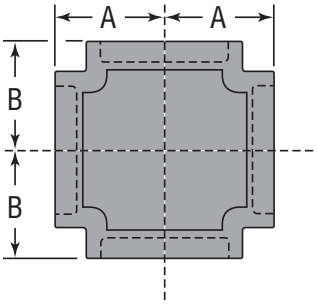
SPF/ANVIL

AnvilStar™
Fire Products Division of Anvil® International

Cast Iron - Class 125 Fittings

Submittal Sheet

CROSS						
Nominal Size	Anvil Item Number	Universal Number	Max. Working Pressure	Dimensions- In.(mm)		Approx. W t. Each
				A	B	
In. (mm)			*PSI (kPa)*	*In. (mm)*	*In. (mm)*	*Lbs. (kg)*
1 *25*	800005696	CX033	300 *2065*	1.50 *38.10*	1.50 *38.10*	1.54 *0.70*
1¼ *32*	800005704	CX044	300 *2065*	1.75 *44.45*	1.75 *44.45*	2.40 *1.09*
1½ *40*	800005712	CX055	300 *2065*	1.94 *49.276*	1.94 *49.27*	3.10 *1.41*
2 *50*	800005720	CX066	300 *2065*	2.25 *57.15*	2.25 *57.15*	4.00 *1.81*
1¼ x 1 *32 x 25*	800006728	CX043	300 *2065*	1.58 *40.13*	1.67 *42.41*	2.05 *0.93*
1½ x 1 *40 x 25*	800006736	CX053	300 *2065*	1.65 *41.91*	1.80 *45.72*	2.40 *1.09*
2 x 1 *50 x 25*	800006744	CX063	300 *2065*	1.73 *38.60*	2.02 *44.45*	2.75 *1.25*



MATERIAL SPECIFICATIONS

Cast iron threaded fittings are UL & ULC Listed & Factory Mutual Approved for 300 psi service.

Gray iron per ASTM A126 Class B.

Dimensions conform to ANSI B16.4 Class 125.

Threads are NPT per ANSI/ASME B1.20.1.

UL FM ULC
APPROVED
For Listing / Approval details contact your AnvilStar™ Representative.

PROJECT INFORMATION:		APPROVAL STAMP:
Project:		
Date:	**Phone:**	
Architect / Engineer:		
Contractor:		
Address:		
Notes 1:		
Notes 2:		

For the latest UL/ULC Listed and FM Approved pressure ratings, versus pipe schedule, go to **www.anvilstar.com** or contact your local AnvilStar representative

ANVIL INTERNATIONAL, INC.

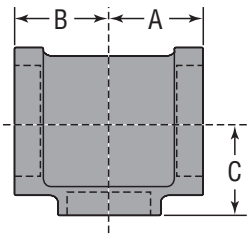
REDUCING TEE

AnvilStar™
Fire Products Division of Anvil® International

SPF/ANVIL

Cast Iron - Class 125 Fittings

Submittal Sheet



REDUCING TEE

Nominal Size	Anvil Item Number	Universal Number	Max. Working Pressure	Dimensions			Approx. Wt. Each
				A	B	C	
In. (mm)			PSI (kPa)	In. (mm)	In. (mm)	In. (mm)	Lbs. (kg)
1 x ½ x 1 25 x 15 x 25	800004244	CT313	300 2065	1.50 38.10	1.36 34.54	1.50 38.10	1.08 0.49
1 x ¾ x 1 25 x 20 x 25	800004251	CT323	300 2065	1.50 38.10	1.45 36.83	1.50 38.10	1.18 0.54
1 x 1 x ½ 25 x 25 x 15	800004269	CT331	300 2065	1.26 32.00	1.26 32.00	1.36 34.54	0.95 0.43
1 x 1 x ¾ 25 x 25 x 20	800004277	CT332	300 2065	1.37 34.79	1.37 34.79	1.45 36.83	1.10 0.50
1¼ x 1 x ½ 32 x 25 x 15	800004301	CT431	300 2065	1.34 34.03	1.26 32.00	1.53 38.86	1.17 0.53
1¼ x 1 x ¾ 32 x 25 x 20	800004319	CT432	300 2065	1.45 36.83	1.37 34.79	1.62 41.14	1.38 0.63
1¼ x 1 x 1 32 x 25 x 25	800004327	CT433	300 2065	1.58 40.13	1.50 38.10	1.57 39.87	1.47 0.67
1¼ x 1 x 1¼ 32 x 25 x 32	800004335	CT434	300 2065	1.75 44.45	1.67 42.41	1.75 44.45	1.80 0.82
1¼ x 1¼ x ½ 32 x 32 x 15	800004350	CT441	300 2065	1.34 34.03	1.34 34.03	1.53 38.86	1.37 0.62
1¼ x 1¼ x ¾ 32 x 32 x 20	800004368	CT442	300 2065	1.45 36.83	1.45 36.83	1.62 41.14	1.54 0.70
1¼ x 1¼ x 1 32 x 32 x 25	800004376	CT443	300 2065	1.58 40.13	1.58 40.13	1.67 42.41	1.65 0.75
1½ x 1 x ½ 40 x 25 x 15	800004400	CT531	300 2065	1.41 35.81	1.34 34.03	1.66 42.16	1.41 0.64
1½ x 1 x ¾ 40 x 25 x 20	800004418	CT532	300 2065	1.52 38.60	1.37 34.79	1.75 44.45	1.65 0.75
1½ x 1 x 1 40 x 25 x 25	800004426	CT533	300 2065	1.65 41.91	1.50 38.10	1.80 45.72	1.65 0.75
1½ x 1 x 1¼ 40 x 25 x 32	800004434	CT534	300 2065	1.82 46.22	1.67 42.41	1.88 47.75	2.00 0.91
1½ x 1 x 1½ 40 x 25 x 40	800004442	CT535	300 2065	1.94 49.27	1.8 45.72	1.94 49.27	2.30 1.04
1½ x 1¼ x ½ 40 x 32 x 15	800004459	CT541	300 2065	1.41 35.81	1.34 34.03	1.66 42.16	1.58 0.72
1½ x 1¼ x ¾ 40 x 32 x 20	800004467	CT542	300 2065	1.52 38.60	1.45 36.83	1.75 44.45	1.72 0.78
1½ x 1¼ x 1 40 x 32 x 25	800004475	CT543	300 2065	1.65 41.91	1.58 40.13	1.80 45.72	1.85 0.84

REDUCING TEE

Nominal Size	Anvil Item Number	Universal Number	Max. Working Pressure	Dimensions			Approx. Wt. Each
				A	B	C	
In. (mm)			PSI (kPa)	In. (mm)	In. (mm)	In. (mm)	Lbs. (kg)
1½ x 1¼ x 1¼ 40 x 32 x 32	800004483	CT544	300 2065	1.82 46.22	1.75 44.45	1.88 47.75	2.22 1.00
1½ x 1¼ x 1½ 40 x 32 x 15	800004491	CT545	300 2065	1.94 49.27	1.88 47.75	1.94 49.27	2.45 1.11
1½ x 1½ x ½ 40 x 40 x 40	800004517	CT551	300 2065	1.41 35.81	1.41 35.81	1.66 42.16	1.76 0.80
1½ x 1½ x ¾ 40 x 40 x 20	800004525	CT552	300 2065	1.52 38.60	1.52 38.60	1.75 44.45	1.87 0.85
1½ x 1½ x 1 40 x 40 x 25	800004533	CT553	300 2065	1.65 41.91	1.65 41.91	1.80 45.72	1.94 0.88
1½ x 1½ x 1¼ 40 x 40 x 32	800004541	CT554	300 2065	1.82 46.22	1.82 46.22	1.88 47.75	2.29 1.04
2 x 1 x 2 50 x 25 x 50	800004566	CT636	300 2065	2.25 57.15	2.02 51.30	2.25 57.15	3.40 1.54
2 x 1¼ x 2 50 x 32 x 50	800004574	CT646	300 2065	2.25 57.15	2.10 53.34	2.25 57.15	2.80 1.27
2 x 1½ x ½ 50 x 40 x 15	800004582	CT651	300 2065	1.49 37.84	1.41 35.81	1.88 47.75	2.09 0.95
2 x 1½ x ¾ 50 x 40 x 20	800004590	CT652	300 2065	1.60 40.64	1.52 38.60	1.97 50.03	2.40 1.09
2 x 1½ x 1 50 x 40 x 25	800004608	CT653	300 2065	1.73 43.94	1.65 41.91	2.02 51.30	2.54 1.15
2 x 1½ x 1¼ 50 x 40 x 32	800004616	CT654	300 2065	1.90 48.26	1.82 46.22	2.10 53.34	2.85 1.30
2 x 1½ x 1½ 50 x 40 x 40	800004624	CT655	300 2065	1.49 37.84	1.41 35.81	1.88 47.75	2.24 1.02
2 x 1½ x2 50 x 40 x 50	800004632	CT656	300 2065	2.25 57.15	2.16 54.86	2.25 57.15	3.75 1.70
2 x 2 x ½ 50 x 50 x 15	800004640	CT661	300 2065	1.49 37.84	1.49 37.84	1.88 47.75	2.60 1.18
2 x 2 x ¾ 50 x 50 x 20	800004657	CT662	300 2065	1.60 40.64	1.60 40.64	1.97 50.03	2.71 1.23
2 x 2 x1 50 x 50 x 15	800004665	CT663	300 2065	1.73 43.94	1.73 43.94	2.02 51.30	2.97 1.35
2 x 2 x1¼ 50 x 50 x 32	800004673	CT664	300 2065	1.90 48.26	1.90 48.26	2.10 53.34	3.32 1.51
2 x 2 x1½ 50 x 50 x 40	800004681	CT665	300 2065	2.02 51.30	2.02 51.30	2.16 54.86	3.72 1.69

MATERIAL SPECIFICATIONS

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Gray iron per ASTM A126 Class B.

Dimensions conform to ANSI B16.4 Class 125.

Threads are NPT per ANSI/ASME B1.20.1.

UL ULC FM
APPROVED
For Listing / Approval details contact your AnvilStar™ Representative.

Project Information:		Approval Stamp:
Project:		
Date:	**Phone:**	
Architect / Engineer:		
Contractor:		
Address:		
Notes 1:		
Notes 2:		

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ANVIL INTERNATIONAL, INC.

PLUG

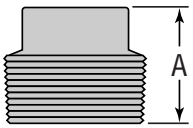
AnvilStar™
Fire Products Division of Anvil® International

SPF/ANVIL

Cast Iron - Class 125 Fittings

Submittal Sheet

PLUG					
Nominal Size	Anvil Item Number	Universal Number	Max. Working Pressure	Dimensions- A	Approx. Wt. Each
In. (mm)			*PSI (kPa)*	*In. (mm)*	*Lbs. (kg)*
½ *15*	800600009	CPL001	300 *2065*	0.94 *23.87*	0.10 *0.05*
¾ *20*	800600017	CPL002	300 *2065*	1.07 *27.17*	0.17 *0.08*
1 *25*	800600025	CPL003	300 *2065*	1.25 *31.75*	0.28 *0.13*
1¼ *32*	800600033	CPL004	300 *2065*	1.36 *34.54*	0.44 *0.20*
1½ *40*	800600041	CPL005	300 *2065*	1.45 *36.83*	0.62 *0.28*
2 *50*	800600058	CPL006	300 *2065*	1.56 *39.62*	0.91 *0.41*



MATERIAL SPECIFICATIONS

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Gray iron per ASTM A126 Class B.

Dimensions conform to ANSI B16.4 Class 125.

Threads are NPT per ANSI/ASME B1.20.1.

UL FM ULC
APPROVED
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Project Information:		Approval Stamp:
Project:		
Date:	**Phone:**	
Architect / Engineer:		
Contractor:		
Address:		
Notes 1:		
Notes 2:		

STRAIGHT TEE

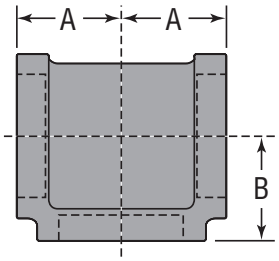
AnvilStar™
Fire Products Division of Anvil® International

SPF/ANVIL

Cast Iron - Class 125 Fittings

Submittal Sheet

STRAIGHT TEE						
Nominal Size	Anvil Item Number	Universal Number	Max. Working Pressure	Dimensions		Approx. Wt. Each
				A	B	
In. (mm)			*PSI (kPa)*	*In. (mm)*	*In. (mm)*	*Lbs. (kg)*
1 *25*	800003204	CT333	300 *2065*	1.50 *38.10*	1.50 *38.10*	1.21 *0.55*
1¼ *32*	800003212	CT444	300 *2065*	1.75 *44.45*	1.75 *44.45*	1.87 *0.85*
1½ *40*	800003220	CT555	300 *2065*	1.94 *49.27*	1.94 *49.27*	2.51 *1.14*
2 *50*	800003238	CT666	300 *2065*	2.25 *57.15*	2.25 *57.15*	3.96 *1.80*
2½ *65*	800003246	CT777	300 *2065*	2.70 *68.58*	2.70 *68.58*	6.45 *2.93*



MATERIAL SPECIFICATIONS

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Gray iron per ASTM A126 Class B.

Dimensions conform to ANSI B16.4 Class 125.

Threads are NPT per ANSI/ASME B1.20.1.

UL FM ULC
APPROVED
For Listing / Approval details contact your AnvilStar™ Representative.

PROJECT INFORMATION:		APPROVAL STAMP:
Project:		
Date:	**Phone:**	
Architect / Engineer:		
Contractor:		
Address:		
Notes 1:		
Notes 2:		

BULL HEAD TEE

AnvilStar™
Fire Products Division of Anvil® International

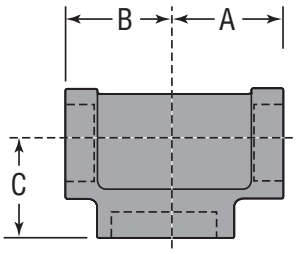
SPF/ANVIL™

Cast Iron - Class 125 Fittings

Submittal Sheet

BULL HEAD TEE

Nominal Size	Anvil Item Number	Universal Number	Max. Working Pressure	Dimensions			Approx. Wt. Each
				A	B	C	
In. (mm)	*In. (mm)*	*PSI (kPa)*	*PSI (kPa)*	*In. (mm)*	*In. (mm)*	*In. (mm)*	*Lbs. (kg)*
1 x 1 x 1¼ *25 x 25 x 32*	800004285	CT334	300 *2065*	1.67 *42.418*	1.67 *42.418*	1.58 *40.132*	1.52 *0.69*
1 x 1 x 1½ *25 x 25 x 40*	800004293	CT335	300 *2065*	1.8 *45.72*	1.8 *45.72*	1.65 *41.91*	1.73 *0.78*
1¼ x 1 x 1½ *32 x 25 x 40*	800004343	CT435	300 *2065*	1.88 *47.752*	1.8 *45.72*	1.82 *46.228*	2.05 *0.93*
1¼ x 1¼ x 1½ *32 x 32 x 40*	800004384	CT445	300 *2065*	1.88 *47.752*	1.88 *47.752*	1.82 *46.228*	2.21 *1.00*
1¼ x 1 ¼ x 2 *25 x 25 x 40*	800004392	CT446	300 *2065*	2.1 *53.34*	2.1 *53.34*	1.9 *48.26*	2.55 *1.16*
1½ x 1¼ x 2 *40 x 32 x 40*	800004509	CT546	300 *2065*	2.16 *54.864*	2.1 *53.34*	2.02 *51.308*	2.80 *1.27*
1½ x 1½ x 2 *40 x 40 x 50*	800004558	CT556	300 *2065*	2.16 *54.864*	2.16 *54.864*	2.02 *51.308*	3.28 *1.41*
2 x 2 x 2½ *50 x 50 x 60*	800004699	CT667	300 *2065*	2.6 *66.04*	2.6 *66.04*	2.39 *60.706*	5.10 *2.31*



MATERIAL SPECIFICATIONS

Cast iron threaded fittings are UL & ULC Listed & Factory Mutual Approved for 300 psi service.

Gray iron per ASTM A126 Class B.

Dimensions conform to ANSI B16.4 Class 125.

Threads are NPT per ANSI/ASME B1.20.1.

UL FM ULC
APPROVED
For Listing / Approval details contact your AnvilStar™ Representative.

Project Information:		Approval Stamp:
Project:		
Date:	**Phone:**	
Architect / Engineer:		
Contractor:		
Address:		
Notes 1:		
Notes 2:		

For the latest UL/ULC Listed and FM Approved pressure ratings, versus pipe schedule, go to **www.anvilstar.com** or contact your local AnvilStar representative

ANVIL INTERNATIONAL, INC.

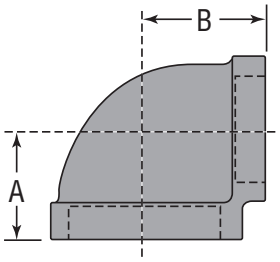
REDUCING 90° ELBOW

AnvilStar™
Fire Products Division of Anvil® International

SPF/ANVIL

Cast Iron - Class 125 Fittings

Submittal Sheet



REDUCING 90° ELBOW						
Nominal Size	Anvil Item Number	Universal Number	Max. Working Pressure	Dimensions		Approx. Wt. Each
				A	B	
In. (mm)			*PSI (kPa)*	*In. (mm)*	*In. (mm)*	*Lbs. (kg)*
1 x ½ *25 x 15*	800001042	CB90031	300 *2065*	1.26 *32.00*	1.36 *34.54*	0.64 *0.29*
1 x ¾ *25 x 20*	800001059	CB90032	300 *2065*	1.37 *34.79*	1.45 *36.83*	0.87 *0.39*
1¼ x ½ *32 x15*	800001067	CB90041	300 *2065*	1.34 *34.03*	1.53 *38.86*	0.96 *0.44*
1¼ x ¾ *32 x 20*	800001075	CB90042	300 *2065*	1.45 *36.83*	1.62 *41.14*	1.13 *0.51*
1¼ x 1 *32 x 25*	800001083	CB90043	300 *2065*	1.58 *40.13*	1.67 *42.41*	1.16 *0.53*
1½ x ½ *40 x15*	800001091	CB90051	300 *2065*	1.41 *35.81*	1.66 *42.16*	1.17 *0.53*
1½ x ¾ *40 x 20*	800001109	CB90052	300 *2065*	1.52 *38.60*	1.75 *44.45*	1.28 *0.58*
1½ x 1 *40 x 25*	800001117	CB90053	300 *2065*	1.65 *41.91*	1.80 *45.72*	1.51 *0.68*
1½ x 1¼ *40 x 32*	800001125	CB90054	300 *2065*	1.82 *46.22*	1.88 *47.75*	1.62 *0.73*
2 x ½ *50 x 40*	800001133	CB90061	300 *2065*	1.49 *37.84*	1.88 *47.75*	2.00 *0.91*
2 x ¾ *50 x 20*	800001141	CB90062	300 *2065*	1.60 *40.64*	1.97 *50.03*	2.05 *0.93*
2 x 1 *50 x 25*	800001158	CB90063	300 *2065*	1.73 *43.94*	2.02 *51.30*	2.10 *0.95*
2 x 1¼ *50 x 32*	800001166	CB90064	300 *2065*	1.90 *48.26*	2.10 *53.34*	2.30 *1.04*
2 x 1½ *50 x 40*	800001174	CB90065	300 *2065*	2.02 *51.30*	2.16 *54.86*	2.60 *1.18*

MATERIAL SPECIFICATIONS

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Gray iron per ASTM A126 Class B.

Dimensions conform to ANSI B16.4 Class 125.

Threads are NPT per ANSI/ASME B1.20.1.

UL FM ULC
APPROVED
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PROJECT INFORMATION:		APPROVAL STAMP:
Project:		
Date:	**Phone:**	
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ANVIL INTERNATIONAL, INC.

90° ELBOW

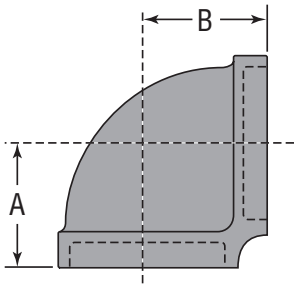
AnvilStar™
Fire Products Division of Anvil® International

SPF/ANVIL

Cast Iron - Class 125 Fittings

Submittal Sheet

90° ELBOW						
Nominal Size	Anvil Item Number	Universal Number	Max. Working Pressure	Dimensions		Approx. Wt. Each
				A	B	
In. (mm)			*PSI (kPa)*	*In. (mm)*	*In. (mm)*	*Lbs. (kg)*
1 *25*	800000002	CB90033	300 *2065*	1.50 *38.10*	1.50 *38.10*	0.84 *0.38*
1¼ *32*	800000010	CB90044	300 *2065*	1.75 *44.45*	1.75 *44.45*	1.34 *0.61*
1½ *40*	800000028	CB90055	300 *2065*	1.94 *49.27*	1.94 *49.27*	1.80 *0.82*
2 *50*	800000036	CB90066	300 *2065*	2.25 *57.15*	2.25 *57.15*	2.90 *1.32*
2½ *65*	800000044	CB90077	300 *2065*	2.70 *68.58*	2.70 *68.58*	4.75 *2.15*



MATERIAL SPECIFICATIONS

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Gray iron per ASTM A126 Class B.

Dimensions conform to ANSI B16.4 Class 125.

Threads are NPT per ANSI/ASME B1.20.1.

UL FM ULC
APPROVED
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Notes 2:		

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ANVIL INTERNATIONAL, INC.

45° ELBOW

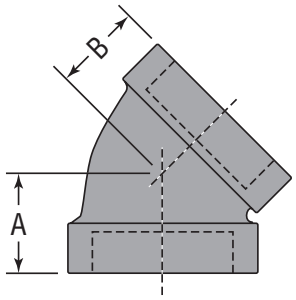
SPF/ANVIL

Cast Iron - Class 125 Fittings

AnvilStar™
Fire Products Division of Anvil® International

Submittal Sheet

45° ELBOW						
Nominal Size	Anvil Item Number	Universal Number	Max. Working Pressure	Dimensions		Approx. Wt. Each
				A	B	
In. (mm)			*PSI (kPa)*	*In. (mm)*	*In. (mm)*	*Lbs. (kg)*
1 *25*	800002172	CB45033	300 *2065*	1.12 *28.448*	1.12 *28.448*	0.84 *0.38*
1¼ *32*	800002180	CB45044	300 *2065*	1.29 *32.766*	1.29 *32.766*	1.40 *0.64*
1½ *40*	800002198	CB45055	300 *2065*	1.43 *36.322*	1.43 *36.322*	1.80 *0.82*
2 *50*	800002206	CB45066	300 *2065*	1.68 *42.672*	1.68 *42.672*	2.79 *1.25*



MATERIAL SPECIFICATIONS

Cast iron threaded fittings are UL & ULC Listed & Factory Mutual Approved for 300 psi service.

Gray iron per ASTM A126 Class B.

Dimensions conform to ANSI B16.4 Class 125.

Threads are NPT per ANSI/ASME B1.20.1.

UL FM ULC
APPROVED
For Listing / Approval details contact your AnvilStar™ Representative.

Project Information:		Approval Stamp:
Project:		
Date:	**Phone:**	
Architect / Engineer:		
Contractor:		
Address:		
Notes 1:		
Notes 2:		

For the latest UL/ULC Listed and FM Approved pressure ratings, versus pipe schedule, go to **www.anvilstar.com** or contact your local AnvilStar representative

ANVIL INTERNATIONAL, INC.

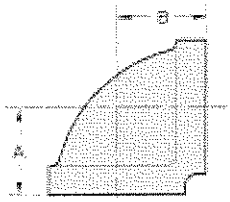
C.I. THREADED FITTINGS

STAR® PIPE PRODUCTS

LISTED LISTED APPROVED

For fire protection services request submittal GRS 1.3

Cast iron threaded fittings are UL, ULC listed and factory mutual approved for 300 psi service. Gray iron per ASTM A126 class B. Dimensions conform to ANSI B16.4 class 125 except plugs conform to ASME B16.14. Threads are NPT per ANSI/ASME B1.20.1.

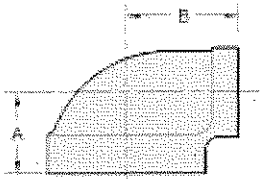


CAST IRON 90 DEGREE ELBOW

NOMINAL SIZE (INCH)	ITEM CODE #	MAX. WORKING P.S.I.	DIMENSIONS A	DIMENSIONS B	WEIGHT EACH PIECE
1	CB90033	300	1.50	1.50	0.95
1 1/4	CB90044	300	1.75	1.75	1.34
1 1/2	CB90055	300	1.94	1.94	1.80
2	CB90066	300	2.25	2.25	2.90
2 1/2	CB90077	300	2.70	2.70	4.75

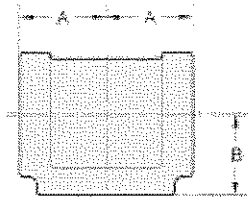
CAST IRON RED. COUPLING

NOMINAL SIZE (INCH)	ITEM CODE #	MAX. WORKING P.S.I.	DIMENSION A	WEIGHT EACH PIECE
1X1/2	CRC031	300	1.70	0.62
1X3/4	CRC032	300	1.70	0.80



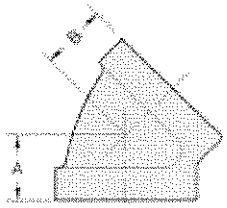
CAST IRON RED. 90 DEG. ELBOW

NOMINAL SIZE (INCH)	ITEM CODE #	MAX. WORKING P.S.I.	DIMENSIONS A	DIMENSIONS B	WEIGHT EACH PIECE
1X1/2	CB90031	300	1.26	1.36	0.64
1X3/4	CB90032	300	1.37	1.45	0.87
1 1/4X1/2	CB90041	300	1.34	1.53	0.96
1 1/4X3/4	CB90042	300	1.45	1.62	1.13
1 1/4X1	CB90043	300	1.58	1.67	1.16
1 1/2x1 1/2	CB90051	300	1.41	1.66	1.17
1 1/2x3/4	CB90052	300	1.52	1.75	1.28
1 1/2X1	CB90053	300	1.65	1.80	1.51
1 1/2X1 1/4	CB90054	300	1.82	1.88	1.62
2X1/2	CB90061	300	1.49	1.88	2.00
2X3/4	CB90062	300	1.60	1.97	2.05
2X1	CB90063	300	1.73	2.02	2.10
2X1 1/4	CB90064	300	1.90	2.10	2.30
2X1 1/2	CB90065	300	2.02	2.16	2.60



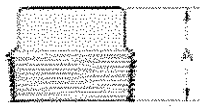
CAST IRON STRAIGHT TEE

NOMINAL SIZE (INCH)	ITEM CODE #	MAX. WORKING P.S.I.	DIMENSIONS A	DIMENSIONS B	WEIGHT EACH PIECE
1	CT333	300	1.50	1.50	1.21
1 1/4	CT444	300	1.75	1.75	1.87
1 1/2	CT555	300	1.94	1.94	2.51
2	CT666	300	2.25	2.25	3.96
2 1/2	CT777	300	2.70	2.70	6.45



CAST IRON 45 DEGREE ELBOW

NOMINAL SIZE (INCH)	ITEM CODE #	MAX. WORKING P.S.I.	DIMENSIONS A	DIMENSIONS B	WEIGHT EACH PIECE
1	CB45033	300	1.12	1.12	0.84
1 1/4	CB45044	300	1.29	1.29	1.40
1 1/2	CB45055	300	1.43	1.43	1.80
2	CB45066	300	1.68	1.68	2.79



CAST IRON PLUGS

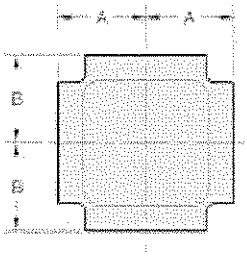
NOMINAL SIZE (INCH)	ITEM CODE #	MAX. WORKING P.S.I.	DIMENSION A	WEIGHT EACH PIECE
1/2	CPL001	300	0.94	0.10
3/4	CPL002	300	1.07	0.17
1	CPL003	300	1.25	0.28
1 1/4	CPL004	300	1.36	0.44
1 1/2	CPL005	300	1.45	0.62
2	CPL006	300	1.56	0.91

C.I. THREADED FITTINGS

STAR® PIPE PRODUCTS

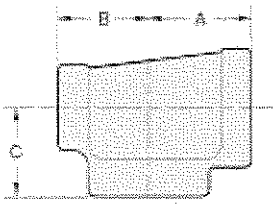
LISTED LISTED APPROVED

For fire protection services request submittal GRS 1.3



CAST IRON CROSS

NOMINAL SIZE (INCH)	ITEM CODE #	MAX. WORKING P.S.I.	DIMENSIONS A	DIMENSIONS B	WEIGHT EACH PIECE
1	CX033	300	1.50	1.50	1.54
1 1/4	CX044	300	1.75	1.75	2.40
1 1/2	CX055	300	1.94	1.94	3.10
2	CX066	300	2.25	2.25	4.00
1 1/4X1	CX043	300	1.58	1.67	2.05
1 1/2X1	CX053	300	1.65	1.80	2.40
2X1	CX063	300	1.73	2.02	2.75



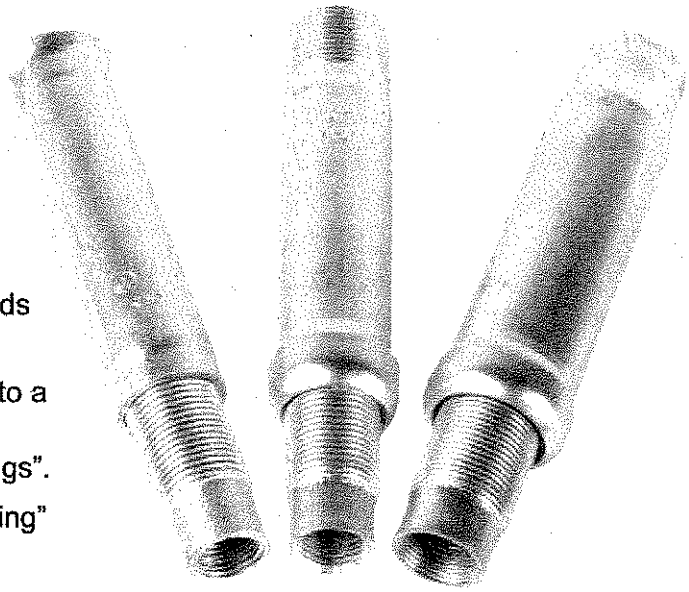
CAST IRON REDUCING TEE

NOMINAL SIZE (INCH)	ITEM CODE #	MAX. WORKING P.S.I.	DIMENSIONS A	DIMENSIONS B	DIMENSIONS C	WEIGHT EACH PIECE
1X1X1/2	CT331	300	1.26	1.26	1.36	0.95
1X1X3/4	CT332	300	1.37	1.37	1.45	1.10
1X1/2X1	CT313	300	1.50	1.36	1.50	1.08
1X3/4X1	CT323	300	1.50	1.45	1.50	1.18
1X1X1 1/4	CT334	300	1.67	1.67	1.58	1.52
1X1X1 1/2	CT335	300	1.80	1.80	1.65	1.73
1 1/4X1X1/2	CT431	300	1.34	1.26	1.53	1.17
1 1/4X1X3/4	CT432	300	1.45	1.37	1.62	1.38
1 1/4X1X1	CT433	300	1.58	1.50	1.57	1.47
1 1/4X1X1 1/4	CT434	300	1.75	1.67	1.75	1.80
1 1/4X1X1 1/2	CT435	300	1.88	1.80	1.82	2.05
1 1/4X1 1/4X1/2	CT441	300	1.34	1.34	1.53	1.37
1 1/4X1 1/4X3/4	CT442	300	1.45	1.45	1.62	1.54
1 1/4X1 1/4X1	CT443	300	1.58	1.58	1.67	1.65
1 1/4X1 1/4X1 1/2	CT445	300	1.88	1.88	1.82	2.21
1 1/4X1 1/4X2	CT446	300	2.10	2.10	1.90	2.55
1 1/2X1X1/2	CT531	300	1.41	1.34	1.66	1.41
1 1/2X1X3/4	CT532	300	1.52	1.37	1.75	1.65
1 1/2X1X1	CT533	300	1.65	1.50	1.80	1.65
1 1/2X1X1 1/4	CT534	300	1.82	1.67	1.88	2.00
1 1/2X1X1 1/2	CT535	300	1.94	1.80	1.94	2.30
1 1/2X1 1/4X1/2	CT541	300	1.41	1.34	1.66	1.58
1 1/2X1 1/4X3/4	CT542	300	1.52	1.45	1.75	1.72
1 1/2X1 1/4X1	CT543	300	1.65	1.58	1.80	1.85
1 1/2x1 1/4x1 1/4	CT544	300	1.82	1.75	1.88	2.22
1 1/2x1 1/4x1 1/2	CT545	300	1.94	1.88	1.94	2.45
1 1/2X1 1/4X2	CT546	300	2.16	2.10	2.02	2.80
1 1/2X1 1/2X1/2	CT551	300	1.41	1.41	1.66	1.76
1 1/2X1 1/2X3/4	CT552	300	1.52	1.52	1.75	1.87
1 1/2X1 1/2X1	CT553	300	1.65	1.65	1.80	1.94
1 1/2X1 1/2X1 1/4	CT554	300	1.82	1.82	1.88	2.29
1 1/2X1 1/2X2	CT556	300	2.16	2.16	2.02	3.28
2X1X2	CT636	300	2.25	2.02	2.25	3.40
2X1 1/4X2	CT646	300	2.25	2.10	2.25	2.80
2X1 1/2X1/2	CT651	300	1.49	1.41	1.88	2.09
2X1 1/2X3/4	CT652	300	1.60	1.52	1.97	2.40
2X1 1/2X1	CT653	300	1.73	1.65	2.02	2.54
2X1 1/2X1 1/4	CT654	300	1.90	1.82	2.10	2.85
2X1 1/2X1 1/2	CT655	300	1.49	1.41	1.88	2.24
2X1 1/2X2	CT656	300	2.25	2.16	2.25	3.75
2X2X1/2	CT661	300	1.49	1.49	1.88	2.60
2X2X3/4	CT662	300	1.60	1.60	1.97	2.71
2X2X1	CT663	300	1.73	1.73	2.02	2.97
2X2X1 1/4	CT664	300	1.90	1.90	2.10	3.32
2X2X1 1/2	CT665	300	2.02	2.02	2.16	3.72
2x2x2 1/2	CT667	300	2.60	2.60	2.39	5.10

Merit Eliminator Adjustable Drop Nipples

eliminate the need to cut drop nipples for positioning sprinkler assemblies flush to the finished ceiling.

- Available in two models, female or male thread inlet, with three standard lengths with adjustment up to 3 inches (7.62 cm)
- UL Listed, FM Approved, and BSA-NYC Approved for installation to NFPA Bulletin 13 requirements. Vds Approved for the European market.
- Cold formed from steel conforming to ASTM A-53, grades E or F.
- Inner nipples employ two (2) "O-Rings" to provide added assurance of sealing. The "F" Model is designed to keep "O-Rings" from impinging upon the one inch (1") inlet threads when fully retracted.
- The bore of the outer nipple is precision formed to a tolerance of +/-.001" while held to a microfinish of 50 to provide for positive sealing of the "O-Rings".
- Each unit is hydrostatically tested to insure "O-Ring" integrity prior to shipment.



- Each unit is marked with a lot number to insure full traceability.
- Qualifying tests on all models are performed at 1500 PSI, while the various models are rated for 300 PSI operation.
- Threads are cut to be better than or equal to the requirements of ANSI B1.20.1, NPT. BSP or DIN 2999 threads also available.

c UL LISTED Factory Mutual System APPROVED VdS ISO 9002 certified

MODEL #	PART # NPT / ISO	INLET NPT / ISO	OUTLET NPT / NPT	MINIMUM LENGTH Inch / mm	MAXIMUM LENGTH Inch / mm	MAXIMUM ADJUST. Inch / mm	MAXIMUM SPRINKLER ORIFICE Inch / mm	WEIGHT Lbs. Kgs.
M1.150*	**531150**	**1" Male**	**1/2" Female**	**4.125**	**5.125**	**1.00**	**0.531**	**1.00**
	551150	25mm Male	13mm Female	104.8	130.2	25.4	13.5	04.5
M3.150	**533150**	**1" Male**	**1/2" Female**	**6.125**	**9.125**	**3.00**	**0.531**	**1.25**
	553150	25mm Male	13mm Female	155.6	231.8	76.2	13.5	05.7
ME3.150*	**543150**	**1" Male**	**1/2" Female**	**7.875**	**10.875**	**3.00**	**0.531**	**1.50**
	563150	25mm Male	13mm Female	200.0	276.2	76.2	13.5	06.8
F1.150	**501150**	**1" Female**	**1/2" Female**	**3.500**	**4.500**	**1.00**	**0.625**	**0.80**
	511150	25mm Female	13mm Female	88.9	114.3	25.4	15.9	03.6
F2.150*	**502150**	**1" Female**	**1/2" Female**	**4.500**	**6.500**	**2.00**	**0.625**	**1.00**
	512150	25mm Female	13mm Female	114.3	165.1	50.8	15.9	04.5
F3.150	**503150**	**1" Female**	**1/2" Female**	**5.500**	**8.500**	**3.00**	**0.531**	**1.25**
	553150	25mm Female	13mm Female	139.7	215.9	76.2	13.5	05.7
F3.175	**503175**	**1" Female**	**3/4" Female**	**6.820**	**10.000**	**3.00**	**0.625**	**1.25**
	553150	25mm Female	19mm Female	150.0	220.0	76.2	15.9	05.7

*Special Order

INSTALLATION & SUGGESTED SPECIFICATION FOR ELIMINATOR ADJUSTABLE DROP NIPPLES

INSTALLATION

A) For use with wet pipe automatic sprinkler systems only.

B) Before starting the job of making sprinklers into steel threads of the above fittings, count the number of fully developed male threads on the brand of sprinkler to be installed into the fittings. If seven (7) perfect threads are counted, the sprinkler should thread into the 1/2" or 3/4" thread from three (3) to four (4) threads hand tight. If five (5) to six (6) threads are counted, the sprinkler should thread into the 1/2" or 3/4" thread from two (2) to three (3) threads hand tight.

C) Use an anaerobic pipe thread sealant for thread make-up. Apply pipe thread sealant only to male threads on the nipple and sprinkler only.

D) If either of the above fails to allow the sprinkler to make-up to a minimum of from five (5) to six (6) full threads, do not overtighten the sprinkler. Instead back the sprinkler out of the fitting. Clean any debris and/or pipe sealant from both the male and female threads. Gauge both the male threads of the sprinkler and the female threads of the Adjustable Drop Nipple for compliance with ANSI B1.2.1, Specification for Tapered Pipe Threads. The same procedure would apply if a leak has been detected.

If within tolerance, reapply the anaerobic pipe sealant and make-on to the required length. refer to the pipe chart on the back of this card for correct make-up lengths. Allow twenty-four hours for setting.

D) Connect the Adjustable Drop Nipple assembly to the sprinkler system by wrenching on the make-up area on the Drop Nipple **DO NOT WRENCH ON THE BARREL PORTION OF THE UNIT OR SPRINKLER.** Damage to the Adjustable Drop Nipple or Sprinkler may result.

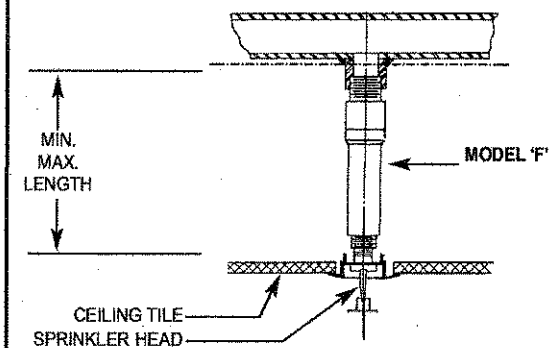
E) After the ceiling has been installed adjust the sprinkler to its final position by using the sprinkler wrench and assemble the escutcheon plate to the inner support ring. It is recommended that the system pressure be relieved when adjusting, however it is not necessary to drain the system.

FOR SPRINKLER PIPING SYSTEMS...
SPECIFY MERIT ELIMINATOR ADJUSTABLE DROP NIPPLES.

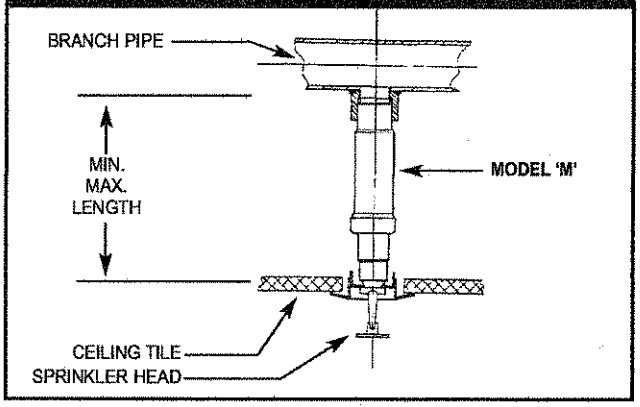
Sprinkler piping systems shall employ Merit Eliminator Adjustable Drop Nipples (Models M & F) to provide flush fit of the sprinkler assembly (concealed, recessed, or pendant) to the finished ceiling.

Adjustable Drop Nipples shall be formed from steel tube conforming to ASTM A53, Grade E or F, threaded per ANSI B1.20.1 or ISO7-1, contain two ethylene propylene (EPDM) "O"-Rings for sealing purposes, while the bore of the outer case of the Adjustable Drop Nipple have minimally a 50 microfinish and held to +/-0.001" to insure sealing over the entire range of adjustment. The Adjustable Drop Nipple shall be Underwriters Laboratories, Inc. Listed, Factory Mutual Research Corp. and Verband der Sachversicherer e. v. Approved for installation in accordance with Bulletin 13 of the National Fire Protection Association. Eliminator Adjustable Drop Nipples are to be manufactured in the United States of America by Merit Manufacturing, Pottstown, Pennsylvania 19464-3811 • Telephone 610-327-4000 • or Fax Toll Free 1-800-543-7013 • www.meritmfg.com

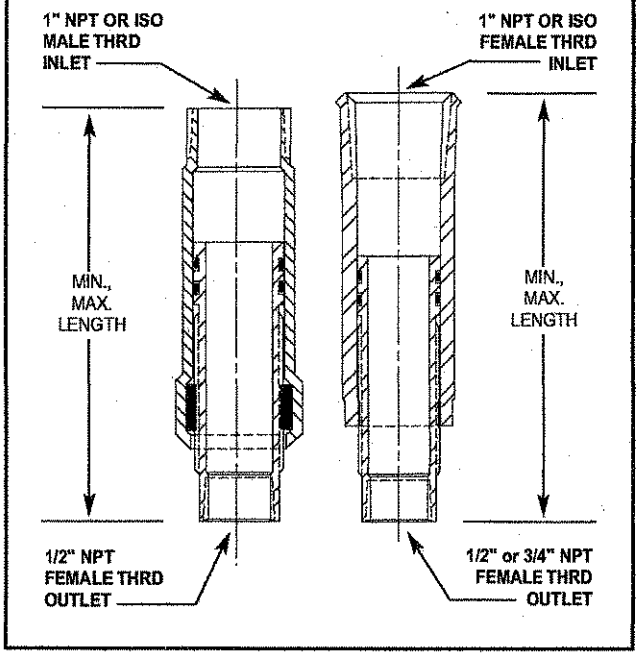
• MODEL 'F' INSTALLATION



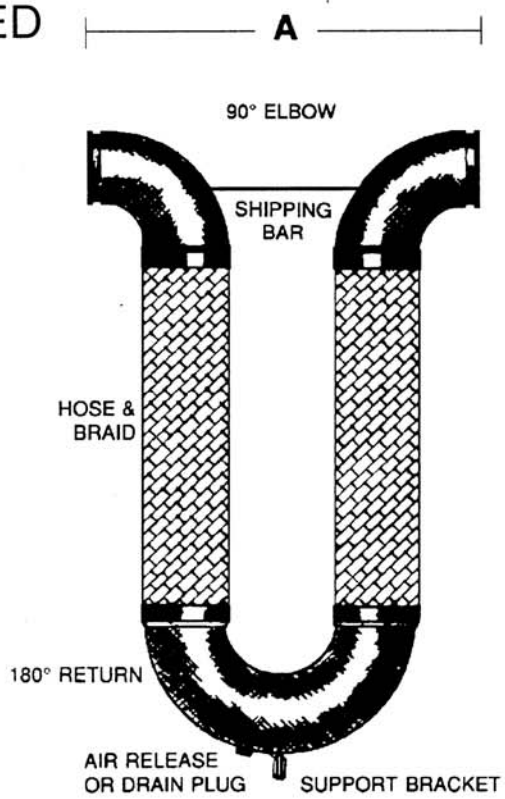
• MODEL 'M' INSTALLATION



• DRAWING OF MODEL 'M' & 'F'



GROOVED ENDS " 8 "



MATERIALS OF CONSTRUCTION

End fittings GROOVED

Hose & Braid STAINLESS STEEL

90° Elbow C/S SCHED 40

180° Return C/S SCHED 40

LISTED
For Fire Sprinkler Systems

NOTE: METRALOOPS 2" AND LARGER INSTALLED IN ANY ORIENTATION OTHER THAN HANGING DOWN *MUST* HAVE THE 180° RETURN SUPPORTED. (SEE INSTALLATION INSTRUCTIONS.)

QTY	SIZE	MODEL	MOVEMENT	A END TO END	B LENGTH	PSI	SPRING FORCE LBS.*	WEIGHT LBS.
	2"(50mm)	MLUG160200	+ / - 8"	23"	30"	300	78	19
	2-1/2"(65mm)	MLUG160250	+ / - 8"	25"	34"	300	83	31
	3"(80mm)	MLUG160300	+ / - 8"	27"	37"	300	90	45
	4"(100mm)	MLUG160400	+ / - 8"	31.5"	43"	175	120	64
	5"(125mm)	MLUG160500	+ / - 8"	36"	48"	175	186	105
	6"(150mm)	MLUG160600	+ / - 8"	42"	55"	175	202	160
	8"(200mm)	MLUG160800	+ / - 8"	56"	70"	175	260	297

*Spring force: these values reflect the total force required to move the Metraloop it's full rated movement for 150 p.s.i. @ 70° F.

ALL DIMENSIONS IN INCHES

CUSTOMER _____

PROJECT _____

ENGINEER _____

ARCHITECT _____

PRO OR P.O. NO. _____

the Metraflex® company
CHICAGO ILLINOIS

DESCRIPTION:
METRAFLEX FIRELOOP™
US Patent No. 5,195,784

DRAWN BY:	DATE:	DRAWING NO:
WG	5/18/03	FIRELOOP 8

SECTION II

FIRE SPRINKLERS

tyco / Fire & Building Products

Technical Services: Tel: (800) 381-9312 / Fax: (800) 791-5500

Series TY-FRB — 2.8, 4.2, 5.6, and 8.0 K-factor Upright, Pendent, and Recessed Pendent Sprinklers Quick Response, Standard Coverage

General Description

The Series TY-FRB, 2.8, 4.2, 5.6, and 8.0 K-factor, Upright and Pendent Sprinklers described in this data sheet are quick response - standard coverage, decorative 3 mm glass bulb type spray sprinklers designed for use in light or ordinary hazard, commercial occupancies such as banks, hotels, shopping malls, etc.

The recessed version of the Series TY-FRB Pendent Sprinkler, where applicable, is intended for use in areas with a finished ceiling. It uses either a two-piece Style 10 (1/2 inch NPT) or Style 40 (3/4 inch NPT) Recessed Escutcheon with 1/2 inch (12,7 mm) of recessed adjustment or up to 3/4 inch (19,1 mm) of total adjustment from the flush pendent position, or a two-piece Style 20 (1/2 inch NPT) or Style 30 (3/4 inch NPT) Recessed Escutcheon with 1/4 inch (6,4 mm) of recessed adjustment or up to 1/2 inch (12,7 mm) of total adjustment from the flush pendent position. The adjustment provided by the Recessed Escutcheon reduces the accuracy to which the fixed pipe drops to the sprinklers must be cut.

Corrosion resistant coatings, where applicable, are utilized to extend the life of copper alloy sprinklers beyond that which would otherwise be obtained when exposed to corrosive atmospheres. Although corrosion resistant coated sprinklers have passed the standard corrosion tests of the applicable approval agencies, the testing is not representative of all possible corrosive atmospheres. Consequently, it is recommended that the end user be consulted with respect to the suitability of these coatings for any given corrosive environment. The effects of ambient temperature, concentration of chemicals, and gas/chemical velocity, should be considered, as a minimum, along with the corrosive nature of the chemical to which the sprinklers will be exposed.

An intermediate level versions of the Series TY-FRB Pendent Sprinklers are detailed in Technical Data Sheet TFP356, and Sprinkler Guards are detailed in Technical Data Sheet TFP780

IMPORTANT

Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.

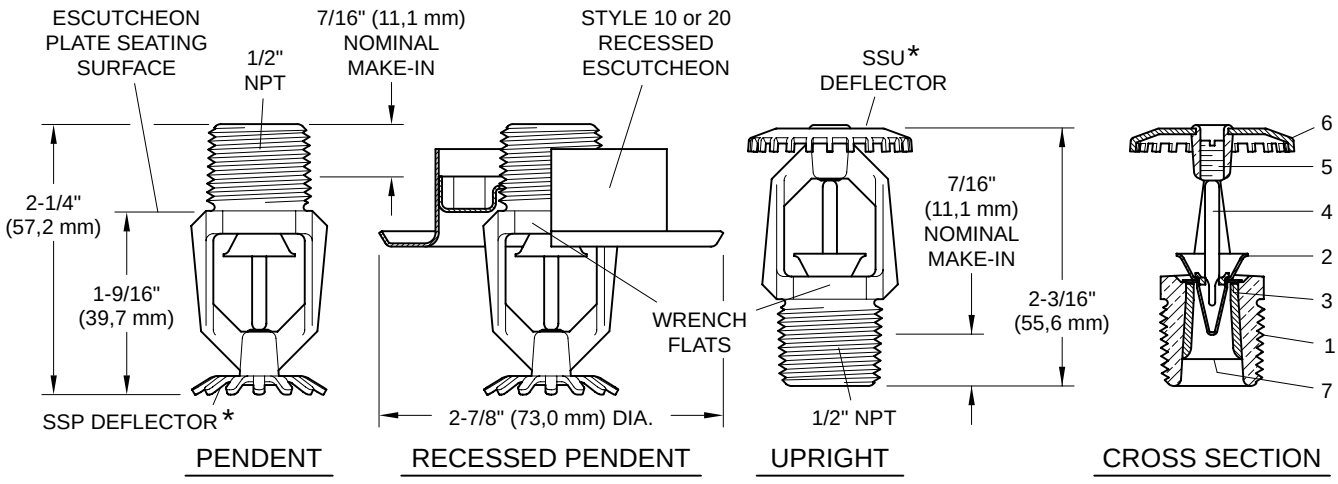
WARNINGS

The Series TY-FRB Sprinklers described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. ***Failure to do so may impair the performance of these devices.***

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.

Model/Sprinkler Identification Numbers

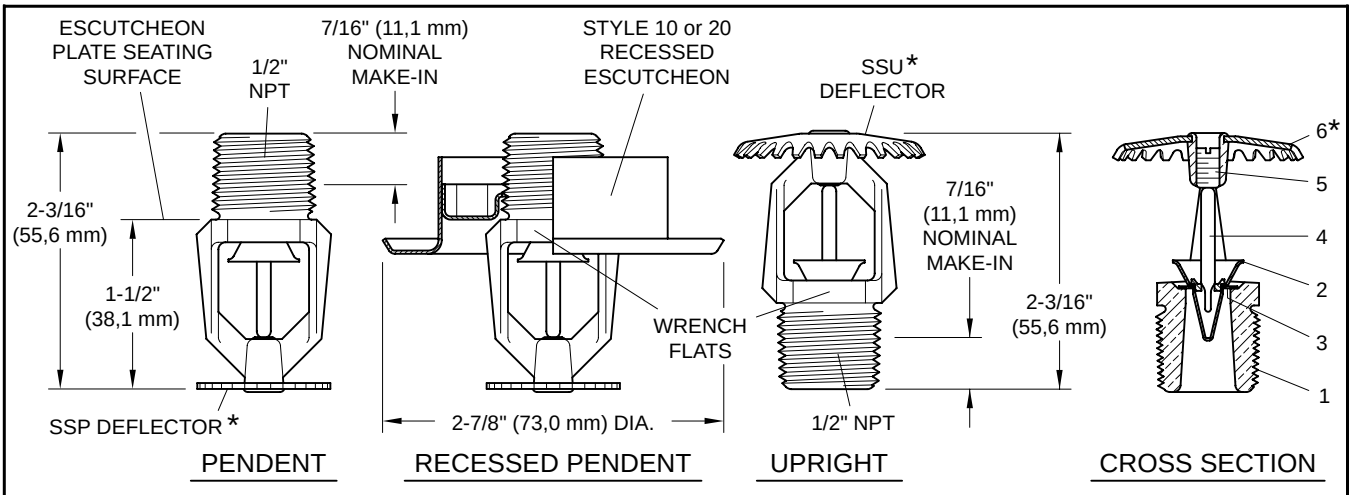
TY1131 -	**Upright**	**2.8K, 1/2"NPT**
TY1231 -	**Pendent**	**2.8K, 1/2"NPT**
TY2131 -	**Upright**	**4.2K, 1/2"NPT**
TY2231 -	**Pendent**	**4.2K, 1/2"NPT**
TY3131 -	**Upright**	**5.6K, 1/2"NPT**
TY3231 -	**Pendent**	**5.6K, 1/2"NPT**
TY4131 -	**Upright**	**8.0K, 3/4"NPT**
TY4231 -	**Pendent**	**8.0K, 3/4"NPT**
TY4831-	**Upright**	**8.0K, 1/2"NPT**
TY4931-	**Pendent**	**8.0K, 1/2"NPT**



1 - Frame
2 - Button
3 - Sealing Assembly
4 - Bulb
5 - Compression Screw
6 - Deflector
7 - Bushing

* Temperature rating is indicated on deflector or adjacent to orifice seat on frame.

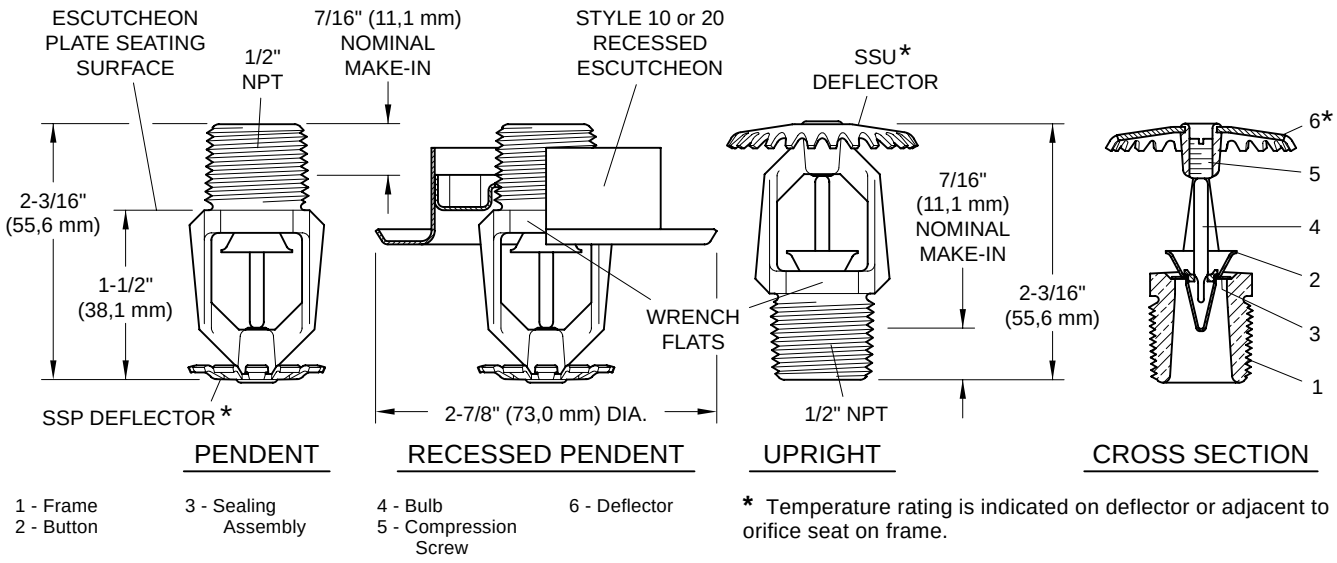
FIGURE 1
QUICK RESPONSE SERIES TY-FRB UPRIGHT (TY1131) AND PENDENT (TY1231) SPRINKLERS
2.8 K-FACTOR, 1/2 INCH NPT



1 - Frame
2 - Button
3 - Sealing Assembly
4 - Bulb
5 - Compression Screw
6 - Deflector

* Temperature rating is indicated on deflector or adjacent to orifice seat on frame.

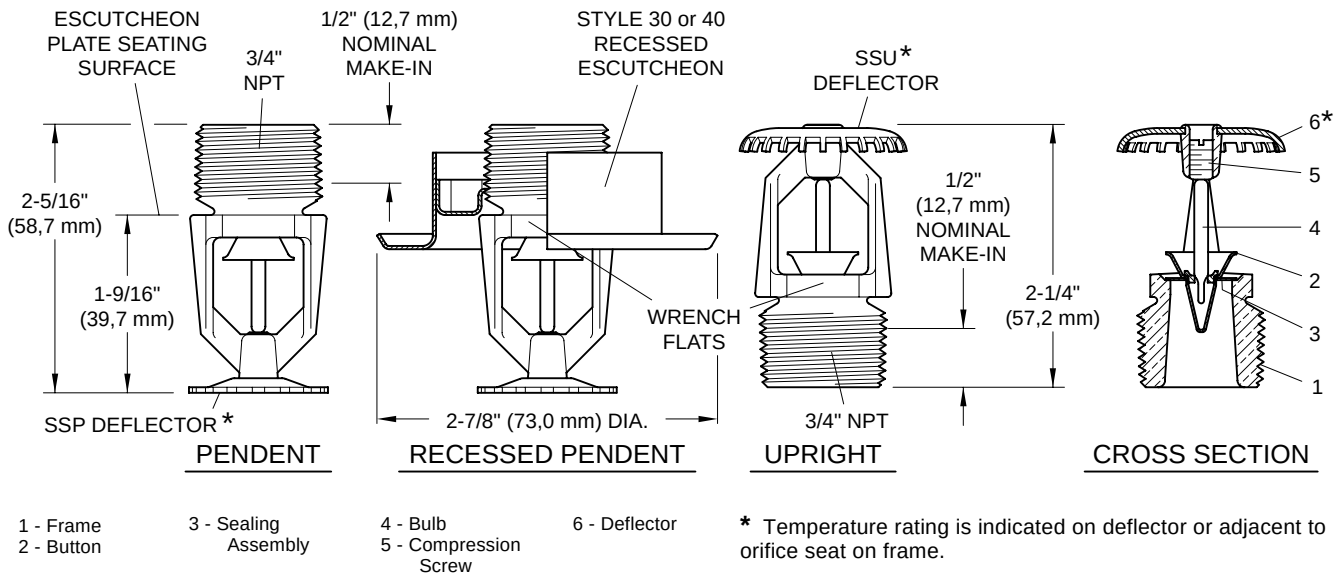
FIGURE 2
QUICK RESPONSE SERIES TY-FRB UPRIGHT (TY2131) AND PENDENT (TY2231) SPRINKLERS
4.2 K-FACTOR, 1/2 INCH NPT



1 - Frame
2 - Button
3 - Sealing Assembly
4 - Bulb
5 - Compression Screw
6 - Deflector

* Temperature rating is indicated on deflector or adjacent to orifice seat on frame.

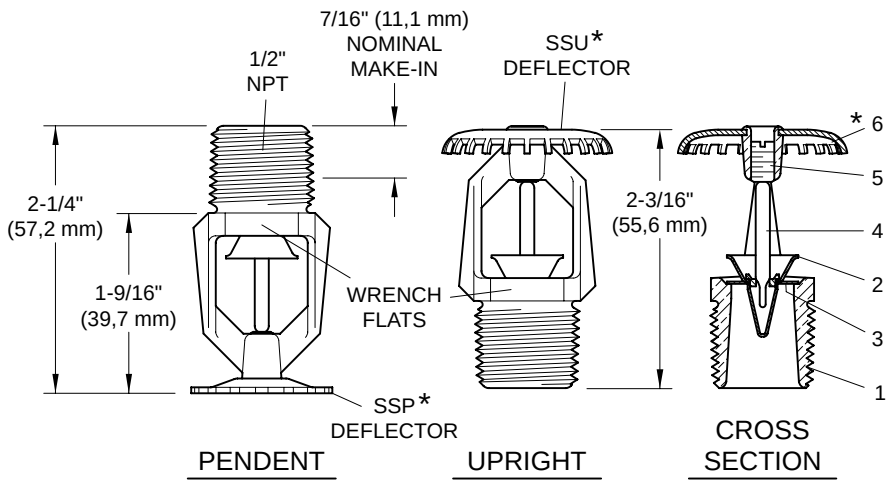
FIGURE 3
QUICK RESPONSE SERIES TY-FRB UPRIGHT (TY3131) AND PENDENT (TY3231) SPRINKLERS
5.6 K-FACTOR, 1/2 INCH NPT



1 - Frame
2 - Button
3 - Sealing Assembly
4 - Bulb
5 - Compression Screw
6 - Deflector

* Temperature rating is indicated on deflector or adjacent to orifice seat on frame.

FIGURE 4
QUICK RESPONSE SERIES TY-FRB UPRIGHT (TY4131) AND PENDENT (TY4231) SPRINKLERS
8.0 K-FACTOR, 3/4 INCH NPT



1 - Frame
2 - Button
3 - Sealing Assembly
4 - Bulb
5 - Compression Screw
6 - Deflector

* Temperature rating is indicated on deflector or adjacent to orifice seat on frame.

FIGURE 5
QUICK RESPONSE SERIES TY-FRB UPRIGHT (TY4831) AND PENDENT (TY4931) SPRINKLERS
8.0 K-FACTOR, 1/2 INCH NPT

Technical Data

Approvals
UL and C-UL Listed.
FM, LPCB, and NYC Approved.
(Refer to Table A and B for complete approval information including corrosion resistant status.)

Maximum Working Pressure
Refer to Table C.

Discharge Coefficient
K = 2.8 GPM/psi$^{1/2}$ (40,3 LPM/bar$^{1/2}$)
K = 4.2 GPM/psi$^{1/2}$ (60,5 LPM/bar$^{1/2}$)
K = 5.6 GPM/psi$^{1/2}$ (80,6 LPM/bar$^{1/2}$)
K = 8.0 GPM/psi$^{1/2}$ (115,2 LPM/bar$^{1/2}$)

Temperature Ratings
Refer to Table A and B

Finishes
Sprinkler: Refer to Table A and B.
Recessed Escutcheon: White Coated, Chrome Plated, or Brass Plated.

Physical Characteristics
Frame . . . . . Bronze
Button . . . . . Brass/Copper
Sealing Assembly . . . . . Beryllium Nickel w/Teflon†
Bulb . . . . . Glass
Compression Screw . . . . . Bronze
Deflector . . . . . Copper/Bronze
Bushing (K=2.8) . . . . . Bronze

Operation

The glass Bulb contains a fluid which expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass Bulb, allowing the sprinkler to activate and water to flow.

Design Criteria

The Series TY-FRB Pendent and Upright Sprinklers are intended for fire protection systems designed in accordance with the standard installation rules recognized by the applicable Listing or Approval agency (e.g., UL Listing is based on the requirements of NFPA 13, and FM Approval is based on the requirements of FM's Loss Prevention Data Sheets). Only the Style 10, 20, 30, or 40 Recessed Escutcheon, as applicable, is to be used for recessed pendent installations.

† DuPont Registered Trademark

K	TYPE	TEMP.	BULB LIQUID	SPRINKLER FINISH (See Note 7) NATURAL BRASS	CHROME PLATED	WHITE*** POLYESTER
2.8 1/2" NPT	PENDENT (TY1231) and UPRIGHT (TY1131)	135°F/57°C	Orange	1, 2, 3, 5		
		155°F/68°C	Red			
		175°F/79°C	Yellow			
		200°F/93°C	Green			
		286°F/141°C	Blue			
	RECESSED PENDENT (TY1231)* Figure 6	135°F/57°C	Orange	1, 2, 5		
		155°F/68°C	Red			
		175°F/79°C	Yellow			
		200°F/93°C	Green			
	RECESSED PENDENT (TY1231)** Figure 7	135°F/57°C	Orange			
		155°F/68°C	Red			
		175°F/79°C	Yellow			
		200°F/93°C	Green			
4.2 1/2" NPT	PENDENT (TY2231) and UPRIGHT (TY2131)	135°F/57°C	Orange	1, 2		
		155°F/68°C	Red			
		175°F/79°C	Yellow			
		200°F/93°C	Green			
		286°F/141°C	Blue			
	RECESSED PENDENT (TY2231)* Figure 8	135°F/57°C	Orange			
		155°F/68°C	Red			
		175°F/79°C	Yellow			
		200°F/93°C	Green			
	RECESSED PENDENT (TY2231)** Figure 9	135°F/57°C	Orange			
		155°F/68°C	Red			
		175°F/79°C	Yellow			
		200°F/93°C	Green			

NOTES:
1. Listed by Underwriters Laboratories, Inc. (UL) as Quick Response Sprinklers.
2. Listed by Underwriters Laboratories, Inc. for use in Canada (C-UL) as Quick Response Sprinklers.
3. Approved by Factory Mutual Research Corporation (FM) as Quick Response Sprinklers.
5. Approved by the City of New York under MEA 354-01-E.
7. Where Polyester Coated Sprinklers are noted to be UL and C-UL Listed, the sprinklers are UL and C-UL Listed as Corrosion Resistant Sprinklers.
* Installed with Style 10 (1/2" NPT) or Style 40 (3/4" NPT) 3/4" Total Adjustment Recessed Escutcheon, as applicable.
** Installed with Style 20 (1/2" NPT) or Style 30 (3/4" NPT) 1/2" Total Adjustment Recessed Escutcheon, as applicable.
*** Frame and Deflector only. Listings and approvals apply to color (Special Order).
N/A: Not Available

TABLE A
LABORATORY LISTINGS AND APPROVALS
2.8 AND 4.2 K-FACTOR SPRINKLERS

				SPRINKLER FINISH (See Note 8)			
K	**TYPE**	**TEMP.**	**BULB LIQUID**	**NATURAL BRASS**	**CHROME PLATED**	**WHITE*** POLYESTER**	**LEAD COATED**
5.6 1/2" NPT	**PENDENT (TY3231) and UPRIGHT (TY3131)**	135°F/57°C	Orange	1, 2, 3, 4, 5, 6, 7			1, 2, 3, 5
		155°F/68°C	Red				
		175°F/79°C	Yellow				
		200°F/93°C	Green				
		286°F/141°C	Blue				
	RECESSED PENDENT (TY3231)* Figure 10	135°F/57°C	Orange	1, 2, 4, 5			N/A
		155°F/68°C	Red				
		175°F/79°C	Yellow				
		200°F/93°C	Green				
	RECESSED PENDENT (TY3231) Figure 11**	135°F/57°C	Orange	1, 2, 3, 4, 5		1, 2, 4, 5	N/A
		155°F/68°C	Red				
		175°F/79°C	Yellow				
		200°F/93°C	Green				
8.0 3/4" NPT	**PENDENT (TY4231) and UPRIGHT (TY4131)**	135°F/57°C	Orange	1, 2, 3, 4, 5, 6, 7			1, 2, 5
		155°F/68°C	Red				
		175°F/79°C	Yellow				
		200°F/93°C	Green				
		286°F/141°C	Blue				
	RECESSED PENDENT (TY4231)* Figure 12	135°F/57°C	Green	1, 2, 4, 5			N/A
		155°F/68°C	Orange				
		175°F/79°C	Red				
		200°F/93°C	Yellow				
	RECESSED PENDENT (TY4231) Figure 13**	135°F/57°C	Orange	1, 2, 3, 4, 5			N/A
		155°F/68°C	Red				
		175°F/79°C	Yellow				
		200°F/93°C	Green				
8.0 1/2" NPT	**PENDENT (TY4931) and UPRIGHT (TY4831)**	135°F/57°C	Orange	1, 2, 4, 5, 6			1, 2, 5
		155°F/68°C	Red				
		175°F/79°C	Yellow				
		200°F/93°C	Green				
		286°F/141°C	Blue				

NOTES:
1. Listed by Underwriters Laboratories, Inc. (UL) as Quick Response Sprinklers.
2. Listed by Underwriters Laboratories, Inc. for use in Canada (C-UL) as Quick Response Sprinklers.
3. Approved by Factory Mutual Research Corporation (FM) as Quick Response Sprinklers.
4. Approved by the Loss Prevention Certification Board (LPCB Ref. No. 007k/04) as Quick Response Sprinklers; however, the LPCB does not rate the thermal sensitivity of recessed sprinklers.
5. Approved by the City of New York under MEA 354-01-E.
6. VdS Approved (For details contact Tyco Fire & Building Products, Enschede, Netherlands, Tel. 31-53-428-4444/Fax 31-53-428-3377).
7. Approved by the Loss Prevention Certification Board (LPCB Ref. No. 094a/06) as Quick Response Sprinklers.
8. Where Polyester Coated and Lead Coated Sprinklers are noted to be UL and C-UL Listed, the sprinklers are UL and C-UL Listed as Corrosion Resistant Sprinklers. Where Lead Coated Sprinklers are noted to be FM Approved, the sprinklers are FM Approved as a Corrosion Resistant Sprinklers.

* Installed with Style 10 (1/2" NPT) or Style 40 (3/4" NPT) 3/4" Total Adjustment Recessed Escutcheon, as applicable.
** Installed with Style 20 (1/2" NPT) or Style 30 (3/4" NPT) 1/2" Total Adjustment Recessed Escutcheon, as applicable.
*** Frame and Deflector only. Listings and approvals apply to color (Special Order).
N/A: Not Available

TABLE B
LABORATORY LISTINGS AND APPROVALS
5.6 AND 8.0 K-FACTOR SPRINKLERS

K	TYPE	SPRINKLER FINISH			
		NATURAL BRASS	CHROME PLATED	WHITE POLYESTER	LEAD COATED
2.8 1/2" NPT	PENDENT (TY3231) and UPRIGHT (TY3131)	175 PSI (12,1 BAR)			N/A
	RECESSED PENDENT (TY323)				
4.2 3/4" NPT	PENDENT (TY4231) and UPRIGHT (TY4131)	175 PSI (12,1 BAR)			N/A
	RECESSED PENDENT (TY4231)				
5.6 1/2" NPT	PENDENT (TY3231) and UPRIGHT (TY3131)	250 PSI (17,2 BAR) OR 175 PSI (12,1 BAR) (SEE NOTE 1)			175 PSI (12,1 BAR)
	RECESSED PENDENT (TY3231)				N/A
8.0 3/4" NPT	PENDENT (TY4231) and UPRIGHT (TY4131)	175 PSI (12,1 BAR)			175 PSI (12,1 BAR)
	RECESSED PENDENT (TY4231)				N/A
8.0 1/2" NPT	PENDENT (TY4931) and UPRIGHT (TY4831)	175 PSI (12,1 BAR)			175 PSI (12,1 BAR)

NOTES:
1. The maximum working pressure of 250 psi (17,2 bar) only applies to the Listing by Underwriters Laboratories Inc. (UL); the Listing by Underwriters Laboratories, Inc. for use in Canada (C-UL); and , the Approval by the City of New York.

TABLE C, MAXIMUM WORKING PRESSURE

Installation

The Series TY-FRB Sprinklers must be installed in accordance with the following instructions:

NOTES

Do not install any bulb type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present. The diameter of the air bubble is approximately 1/16 inch (1,6 mm) for the 135°F/57°C to 3/32 inch (2,4 mm) for the 286°F/141°C temperature ratings.

A leak tight 1/2 inch NPT sprinkler joint should be obtained with a torque of 7 to 14 ft.lbs. (9,5 to 19,0 Nm). A maximum of 21 ft. lbs. (28,5 Nm) of torque may be used to install sprinklers with 1/2 NPT connections. A leak tight 3/4 inch NPT sprinkler joint should be obtained with a torque of 10 to 20 ft.lbs. (13,4 to 26,8 Nm). A maximum of 30 ft.lbs. (40,7 Nm) of torque is to be used to install sprinklers with 3/4 NPT connections. Higher levels of torque may distort the sprinkler inlet and cause leakage or impairment of the sprinkler.

Do not attempt to make-up for insufficient adjustment in the escutcheon plate by under- or over-tightening the sprinkler. Readjust the position of the sprinkler fitting to suit.

The **Series TY-FRB Pendent and Upright Sprinklers** must be installed in accordance with the following instructions.

Step 1. Pendent sprinklers are to be installed in the pendent position, and upright sprinklers are to be installed in the upright position.

Step 2. With pipe thread sealant applied to the pipe threads, hand tighten the sprinkler into the sprinkler fitting.

Step 3. Tighten the sprinkler into the sprinkler fitting using only the W-Type 6 Sprinkler Wrench (Ref. Figure 14). With reference to Figures 1, 2, 3, 4, and 5, the W-Type 6 Sprinkler Wrench is to be applied to the sprinkler wrench flats.

The **Series TY-FRB Recessed Pendent Sprinklers** must be installed in accordance with the following instructions.

Step A. After installing the Style 10. 20, 30, or 40 Mounting Plate, as applicable, over the sprinkler threads and with pipe thread sealant applied to the pipe threads, hand tighten the sprinkler into the sprinkler fitting.

Step B. Tighten the sprinkler into the sprinkler fitting using only the W-Type 7 Recessed Sprinkler Wrench (Ref. Figure 15). With reference to Figure 1, 2, 3, and 4, the W-Type 7 Recessed

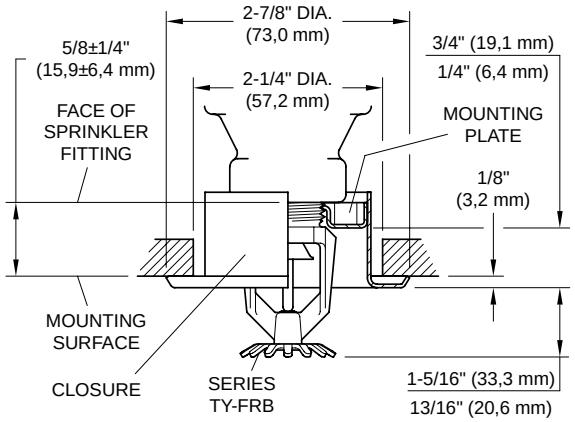


FIGURE 6
SERIES TY-FRB RECESSED PENDENT
WITH TWO-PIECE 3/4 INCH TOTAL ADJUSTMENT
STYLE 10 RECESSED ESCUTCHEON
2.8 K-FACTOR, 1/2 INCH NPT

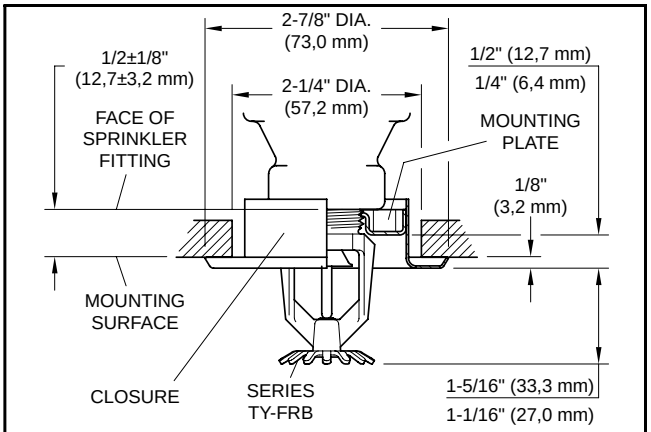


FIGURE 7
SERIES TY-FRB RECESSED PENDENT
WITH TWO-PIECE 1/2 INCH TOTAL ADJUSTMENT
STYLE 20 RECESSED ESCUTCHEON
2.8 K-FACTOR, 1/2 INCH NPT

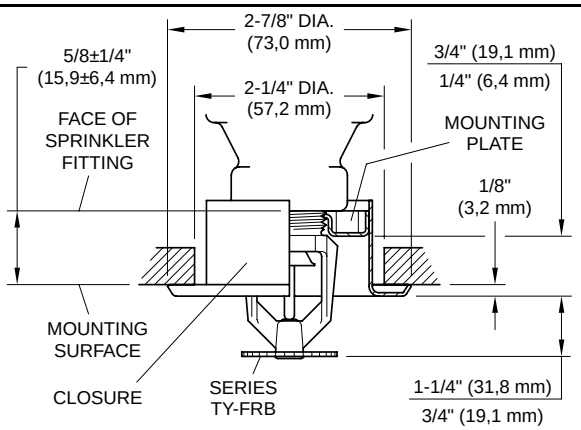


FIGURE 8
SERIES TY-FRB RECESSED PENDENT
WITH TWO-PIECE 3/4 INCH TOTAL ADJUSTMENT
STYLE 10 RECESSED ESCUTCHEON
4.2 K-FACTOR, 1/2 INCH NPT

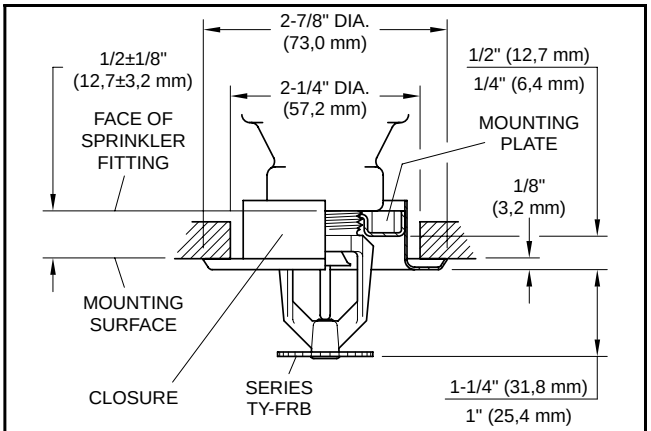


FIGURE 9
SERIES TY-FRB RECESSED PENDENT
WITH TWO-PIECE 1/2 INCH TOTAL ADJUSTMENT
STYLE 20 RECESSED ESCUTCHEON
4.2 K-FACTOR, 1/2 INCH NPT

Sprinkler Wrench is to be applied to the sprinkler wrench flats.

Step C. After the ceiling has been installed or the finish coat has been applied, slide on the Style 10, 20, 30, or 40 Closure over the Series TY-FRB Sprinkler and push the Closure over the Mounting Plate until its flange comes in contact with the ceiling.

Care and Maintenance

The Series TY-FRB Sprinklers must be maintained and serviced in accordance with the following instructions:

NOTES

Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, permission to shut down the affected fire protection system must be obtained from the proper authorities and all personnel who may be affected by this action must be notified.

The owner must assure that the sprinklers are not used for hanging of any objects; otherwise, non-operation in the event of a fire or inadvertent operation may result.

Absence of an escutcheon, which is used to cover a clearance hole, may delay the time to sprinkler operation in a fire situation.

Sprinklers that are found to be leaking or exhibiting visible signs of corrosion must be replaced.

Automatic sprinklers must never be painted, plated, coated or otherwise altered after leaving the factory. Modified sprinklers must be replaced. Sprinklers that have been exposed to corrosive products of combustion, but have not operated, should be replaced if they cannot be completely cleaned by wiping the sprinkler with a cloth or by brushing it with a soft bristle brush.

Care must be exercised to avoid damage to the sprinklers - before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb. (Ref. Installation Section).

Frequent visual inspections are recommended to be initially performed for corrosion resistant coated sprinklers, after the installation has been com-

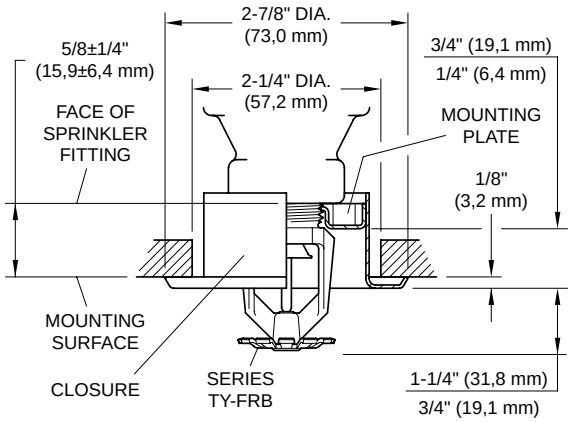


FIGURE 10
SERIES TY-FRB RECESSED PENDENT
WITH TWO-PIECE 3/4 INCH TOTAL ADJUSTMENT
STYLE 10 RECESSED ESCUTCHEON
5.6 K-FACTOR, 1/2 INCH NPT

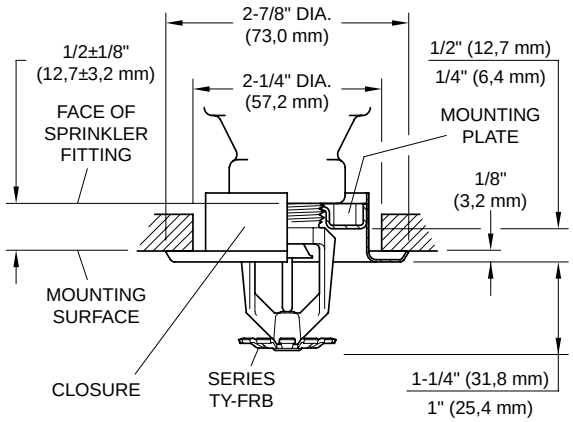


FIGURE 11
SERIES TY-FRB RECESSED PENDENT
WITH TWO-PIECE 1/2 INCH TOTAL ADJUSTMENT
STYLE 20 RECESSED ESCUTCHEON
5.6 K-FACTOR, 1/2 INCH NPT

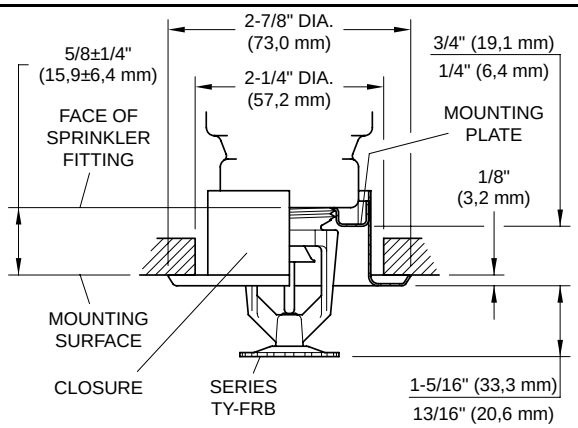


FIGURE 12
SERIES TY-FRB RECESSED PENDENT
WITH TWO-PIECE 3/4 INCH TOTAL ADJUSTMENT
STYLE 40 RECESSED ESCUTCHEON
8.0 K-FACTOR, 3/4 INCH NPT

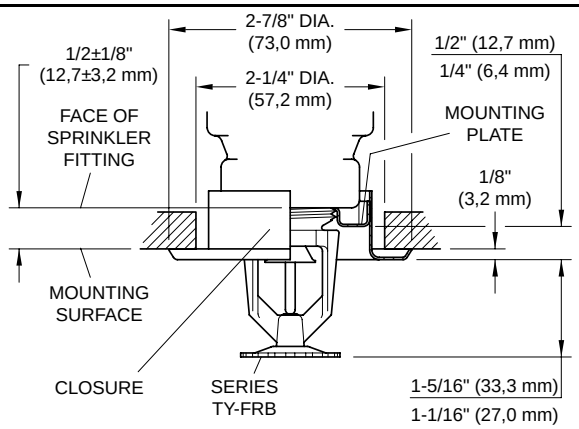


FIGURE 13
SERIES TY-FRB RECESSED PENDENT
WITH TWO-PIECE 1/2 INCH TOTAL ADJUSTMENT
STYLE 30 RECESSED ESCUTCHEON
8.0 K-FACTOR, 3/4 INCH NPT

pleted, to verify the integrity of the corrosion resistant coating. Thereafter, annual inspections per NFPA 25 should suffice; however, instead of inspecting from the floor level, a random sampling of close-up visual inspections should be made, so as to better determine the exact sprinkler condition and the long term integrity of the corrosion resistant coating, as it may be affected by the corrosive conditions present.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any other authorities having jurisdiction. The installing contractor or sprinkler manufacturer should be contacted relative to any questions.

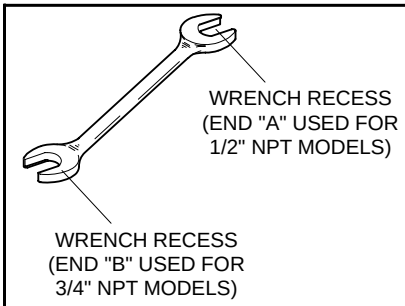


FIGURE 14
W-TYPE 6 SPRINKLER
WRENCH

It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

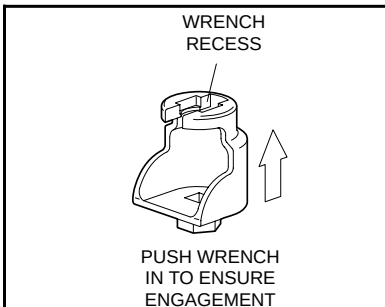


FIGURE 15
W-TYPE 7 RECESSED
SPRINKLER WRENCH

P/N 57 — XXX — X — XXX

		MODEL/SIN
330	2.8K UPRIGHT (1/2"NPT)	TY1131
331	2.8K PENDENT (1/2"NPT)	TY1231
340	4.2K UPRIGHT (1/2"NPT)	TY2131
341	4.2K PENDENT (1/2"NPT)	TY2231
370	5.6K UPRIGHT (1/2"NPT)	TY3131
371	5.6K PENDENT (1/2"NPT)	TY3231
390	8.0K UPRIGHT (3/4"NPT)	TY4131
391	8.0K PENDENT (3/4"NPT)	TY4231
360	8.0K UPRIGHT (1/2"NPT)	TY4831
361	8.0K PENDENT (1/2"NPT)	TY4931

	SPRINKLER
1	NATURAL BRASS
4	WHITE POLYESTER
3	WHITE (RAL9010)*
9	CHROME PLATED
7	LEAD COATED

	TEMPERATURE RATING
135	135°F/57°C
155	155°F/68°C
175	175°F/79°C
200	200°F/93°C
286	286°F/141°C

* Eastern Hemisphere sales only.

TABLE D
PART NUMBER SELECTION
SERIES TY-FRB PENDENT AND UPRIGHT SPRINKLERS

Limited Warranty

Products manufactured by Tyco Fire & Building Products (TFBP) are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by TFBP. No warranty is given for products or components manufactured by companies not affiliated by ownership with TFBP or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by TFBP to be defective shall be either repaired or replaced, at TFBP's sole option. TFBP neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. TFBP shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

In no event shall TFBP be liable, in contract, tort, strict liability or under any other legal theory, for incidental, indirect, special or consequential damages, including but not limited to labor charges, regardless of whether TFBP was informed about the possibility of such damages, and in no event shall TFBP's liability exceed an amount equal to the sales price.

The foregoing warranty is made in lieu of any and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

This limited warranty sets forth the exclusive remedy for claims based on failure of or defect in products, materials or components, whether the claim is made in contract, tort, strict liability or any other legal theory.

This warranty will apply to the full extent permitted by law. The invalidity, in whole or part, of any portion of this warranty will not affect the remainder.

Ordering Procedure

When placing an order, indicate the full product name. Refer to the Price List for complete listing of Part Numbers.

Contact your local distributor for availability.

Sprinkler Assemblies with NPT Thread Connections:
Specify: (Specify Model/SIN), Quick Response, (specify K-factor), (specify temperature rating), Series TY-FRB (specify Pendent or Upright) Sprinkler with (specify type of finish or coating), P/N (specify from Table D).

Recessed Escutcheon:
Specify: Style (10, 20, 30, or 40) Recessed Escutcheon with (specify*) finish, P/N (specify*).

* Refer to Technical Data Sheet TFP770.

Sprinkler Wrench:
Specify: W-Type 6 Sprinkler Wrench, P/N 56-000-6-387.

Specify: W-Type 7 Sprinkler Wrench, P/N 56-850-4-001.

tyco / Fire & Building Products

Technical Services: Tel: (800) 381-9312 / Fax: (800) 791-5500

Series RFII — 5.6 K-factor "Royal Flush II" Pendent Concealed Sprinklers Quick & Standard Response, Standard Coverage

General Description

The Series RFII Quick Response (3 mm bulb) & Standard Response (5 mm bulb), 5.6 K-Factor, "Royal Flush II" Concealed Pendent Sprinklers are decorative sprinklers featuring a flat cover plate designed to conceal the sprinkler. It is the best choice for architecturally sensitive areas such as hotel lobbies, office buildings, churches, and restaurants.

Each unit includes a Cover Plate Assembly that conceals the sprinkler operating components above the ceiling. The separable two-piece design of the Cover Plate and Support Cup Assemblies allows installation of the sprinklers and pressure testing of the fire protection system prior to installation of a suspended ceiling or application of the finish coating to a fixed ceiling. They also permit removal of suspended ceiling panels for access to building service equipment without having to first shut down the fire protection system and remove sprinklers.

Also, the separable two-piece design of the the Sprinkler provides for 1/2 inch (12,7 mm) of vertical adjustment, to reduce the accuracy to which the length of fixed pipe drops to the sprinklers must be cut.

The Series RFII Sprinklers are shipped with a Disposable Protective Cap. The Protective Cap is temporarily removed for installation, and then it can be replaced to help protect the sprinkler while the ceiling is being installed or finished. The tip of the Protective Cap can also be used to mark the center of the ceiling hole into plaster board, ceiling tiles, etc. by gently pushing the ceiling product against the Protective Cap. When the ceiling installation is complete the Protective Cap is removed and the Cover Plate Assembly installed.

As an option, the Series RFII Standard Response (5 mm bulb) "Royal Flush II" Concealed Pendent Sprinklers may be fitted with a silicone Air and Dust Seal (Ref. Fig. 5). The Air and Dust Seal is intended for sensitive areas where it is desirable to stop air and dust travel through the cover plate from the area above the ceiling.

IMPORTANT

Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.

WARNINGS

The Series RFII Concealed Pendent Sprinklers described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. ***Failure to do so may impair the performance of these devices.***

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.

Model/Sprinkler Identification Numbers

TY3551 (5mm bulb) & **TY3531** (3 mm bulb): maximum 175 psi (12,1 bar) by UL, C-UL, FM, LPCB and NYC.
TY3504 (5 mm bulb) & **TY3505** (3 mm bulb): maximum 250 psi (17,3 bar) by UL, C-UL, and NYC. Maximum 175 psi (12,1 bar) by FM.

Technical Data

Approvals for Series RFII
UL and C-UL Listed. FM Approved. NYC under MEA 353-01-E. LPCB (Ref. No. 094a/09 for TY3551 & 094a/10 for TY3531) Approved.

The approvals apply only to the service conditions indicated in the Design Criteria section and maximum pressure ratings indicated in the Model/Sprinkler Identification Numbers section.

Approvals for Air & Dust Seal (Part #10908100)
UL and C-UL Listed for use with the RFII (TY3551 & TY3504) Standard Response Concealed Sprinkler.

Temperature Ratings
155F/68C Sprinkler - 135F/57C Plate
200F/93C Sprinkler - 165F/74C Plate

Discharge Coefficient
K = 5.6 GPM/psi$^{1/2}$ (80,6 LPM/bar$^{1/2}$)

Adjustment
1/2 inch (12,7 mm)

Finishes
Cover Plate: Chrome Plated, Brass Plated, or White Painted (Custom paint matches and colors other than white are available on request.)

Physical Characteristics

Frame	Bronze
Support Cup	Chrome Plated Steel
Guide Pins	Stainless Steel
Deflector	Bronze
Compression Screw	Brass
Bulb	Glass
Cap	Bronze or Copper
Sealing Assembly	Beryllium Nickel w/Teflon*
Cover Plate	Brass
Retainer	Brass
Ejection Spring	Stainless Steel

Patents
U.S.A. 4,014,388

Operation

When exposed to heat from a fire, the Cover Plate, which is normally soldered to the Retainer at three points, falls away to expose the Sprinkler Assembly. At this point the Deflector supported by the Guide Pins drops down to its operational position.

The glass Bulb contains a fluid that expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass Bulb, activating the sprinkler and allowing water to flow.

Design Criteria

The RFII (TY3551 & TY3504), 5 mm Bulb Type, Concealed Pendent Sprinklers are UL and C-UL Listed as standard response - standard spray sprinklers for use in accordance with the current NFPA standard. They are FM Approved as standard response - standard spray sprinklers for use in accordance with the current FM Loss Prevention Data Sheets.

The RFII (TY3531 & TY3505) 3 mm Bulb Type, Concealed Pendent Sprinklers are UL and C-UL Listed as quick response - standard spray sprinklers for use in accordance with the current NFPA standard. They are FM Approved as standard response - standard spray sprinklers for use in accordance with the current FM Loss Prevention Data Sheets.

The Series RFII Concealed Pendent Sprinklers are only listed and approved with the Series RFII Concealed Cover Plates having a metallic or white painted finish.

The Series RFII must not be used in applications where the air pressure above the ceiling is greater than that below. Down drafts through the Support Cup could delay sprinkler operation in a fire situation.

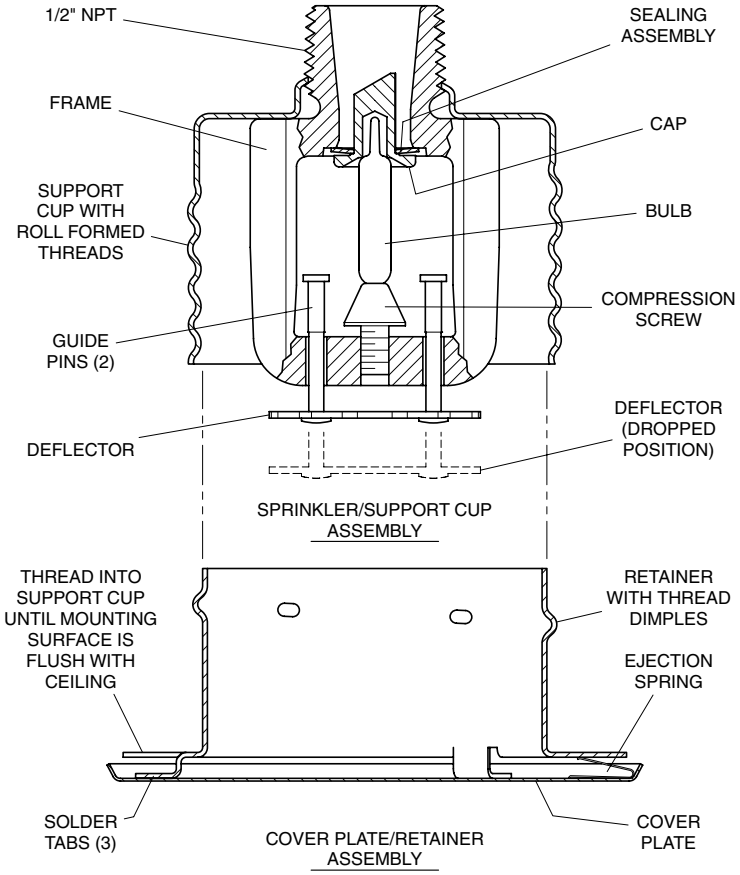


FIGURE 1
SERIES RFII CONCEALED SPRINKLER ASSEMBLY

Installation

The Series RFII must be installed in accordance with the following instructions:

NOTES

Do not install any bulb type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present. The diameter of the air bubble is approximately 1/16 inch (1,6 mm) for the 155°F/68°C and 3/32 inch (2,4 mm) for the 200°F/93°C temperature ratings.

A leak tight 1/2 inch NPT sprinkler joint should be obtained with a torque of 7 to 14 ft.lbs. (9,5 to 19,0 Nm). A maximum of 21 ft.lbs. (28,5 Nm) of torque is to be used to install sprinklers. Higher levels of torque may distort the sprinkler inlet with consequent leakage or impairment of the sprinkler.

Do not attempt to compensate for insufficient adjustment in the Sprinkler Assembly by under- or over-tightening the Sprinkler/Support Cup Assembly. Readjust the position of the sprinkler fitting to suit.

Step 1. The sprinkler must only be installed in the pendent position and with the centerline of the sprinkler perpendicular to the mounting surface.

Step 2. Remove the Protective Cap.

Step 3. With pipe thread sealant applied to the pipe threads, hand tighten the sprinkler into the sprinkler fitting.

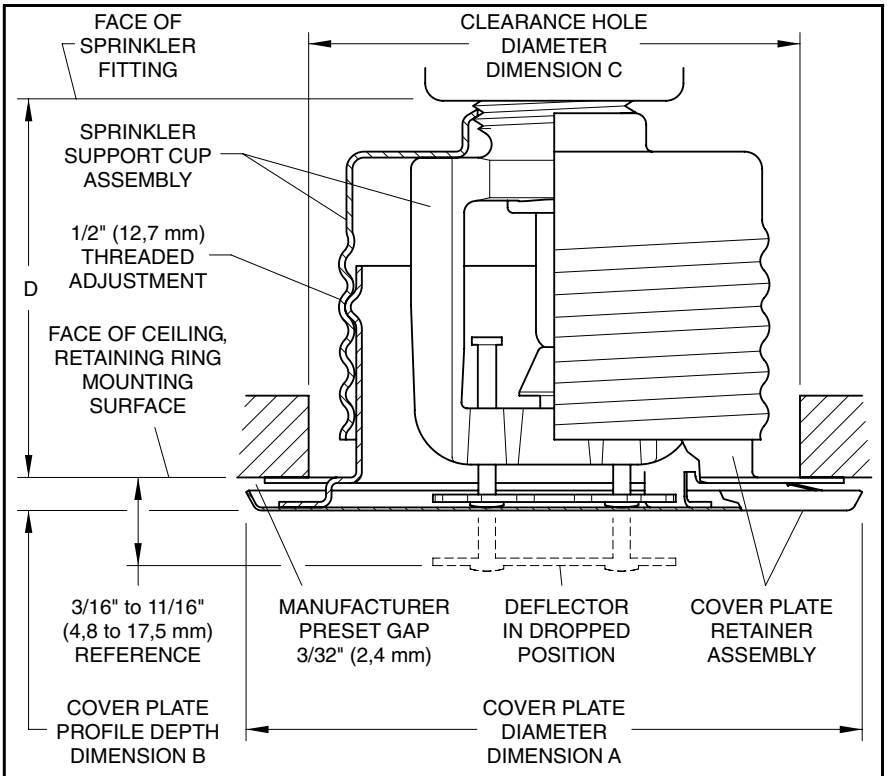
Step 4. Wrench tighten the sprinkler using only the RFII Sprinkler Wrench (Ref. Figure 3). The RFII Sprinkler Wrench is to be applied to the Sprinkler as shown in Figure 3.

Step 5. Replace the Protective Cap (Ref. Figure 4) by pushing it upwards until it bottoms out against the Support Cup. The Protective Cap helps prevent damage to the Deflector and Arms during ceiling installation and/or during application of the finish coating of the ceiling. It may also be used to locate the center of the clearance hole by gently pushing the ceiling material up against the center point of the Protective Cap.

NOTE

As long as the Protective Cap remains in place, the system is considered to be "Out of Service".

* Registered Trademark of DuPont



A: 3-1/4" (82,6 mm) C: 2-3/8" to 2-5/8" (60,3 to 66,7 mm)
B: 3/16" (4,8 mm) D: 1-3/4" to 2-1/4" (44,5 to 57,2 mm)

FIGURE 2
SERIES RFII CONCEALED SPRINKLER INSTALLATION DIMENSIONS

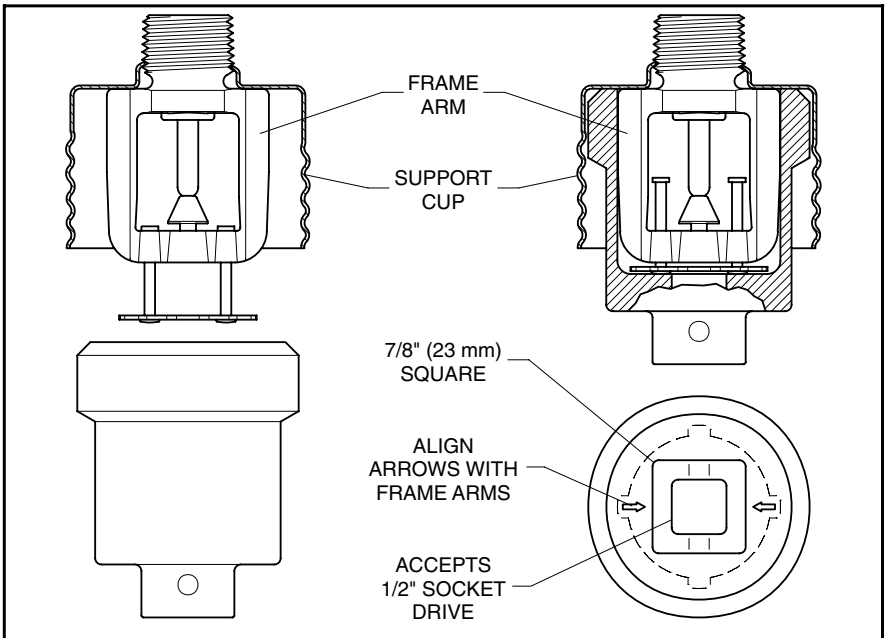


FIGURE 3
RFII SPRINKLER WRENCH

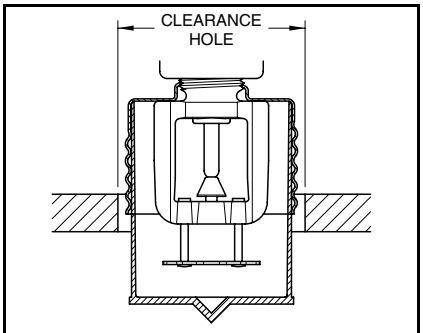


FIGURE 4
DISPOSABLE PROTECTIVE CAP

Step 6. After the ceiling has been completed with the 2-1/2 inch (63,5 mm) diameter clearance hole and in preparation for installing the Cover Plate Assembly, remove and discard the Protective Cap, and verify that the Deflector moves up and down freely. If the Sprinkler has been damaged and the Deflector does not move up and down freely, replace the entire Sprinkler assembly. Do not attempt to modify or repair a damaged sprinkler.

Step 7. When installing an Air and Dust Seal, refer to Figure 5, otherwise proceed to Step 8. To attach the Air and Dust Seal, verify the angle of the outside edge of the seal is oriented according to Figure 5. Start the edge of the Retainer in the grooved slot of the Air and Dust Seal and continue around the retainer until the entire Air and Dust Seal is engaged.

NOTE

The Air and Dust Seal is only to be installed on the periphery of the Retainer.

Step 8. Screw on the Cover Plate/Retainer Assembly until the Retainer - Figure 2 (or Air and Dust Seal - Figure 5) contacts with the ceiling. Do not continue to screw on the Cover Plate/Retainer Assembly such that it lifts a ceiling panel out of its normal position. If the Cover Plate/Retainer Assembly cannot be engaged with the Support Cup or the Cover Plate/Retainer Assembly cannot be engaged sufficiently to contact the ceiling, the Sprinkler Fitting must be repositioned.

Care and Maintenance

The Series RFII must be maintained and serviced in accordance with the following instructions:

NOTES

Absence of the Cover Plate Assembly may delay sprinkler operation in a fire situation.

When properly installed, there is a nominal 3/32 inch (2,4 mm) air gap between the lip of the Cover Plate and the ceiling, as shown in Figure 2. This air gap is necessary for proper operation of the sprinkler. If the ceiling is to be repainted after the installation of the Sprinkler, care must be exercised to ensure that the new paint does NOT seal off any of the air gap.

Factory painted Cover Plates MUST NOT be repainted. They should be replaced, if necessary, by factory painted units.

Do not pull the Cover Plate relative to the Enclosure. Separation may result.

Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, permission to shut down the affected fire protection system must be obtained from the proper authorities and all personnel who may be affected by this action must be notified.

Sprinklers that are found to be leaking or exhibiting visible signs of corrosion must be replaced.

Automatic sprinklers must never be painted, plated, coated or otherwise altered after leaving the factory. Modified sprinklers must be replaced. Sprinklers that have been exposed to corrosive products of combustion, but have not operated, should be replaced if they cannot be completely cleaned by wiping the sprinkler with a cloth or by brushing it with a soft bristle brush.

Care must be exercised to avoid damage to the sprinklers - before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb. (Ref. Installation Section).

If a sprinkler must be removed, do not reinstall it or a replacement without reinstalling the Cover Plate Assembly. If a Cover Plate Assembly becomes dislodged during service, replace it immediately.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any other authorities having jurisdiction. The installing contractor or sprinkler manufacturer should be contacted relative to any questions.

It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

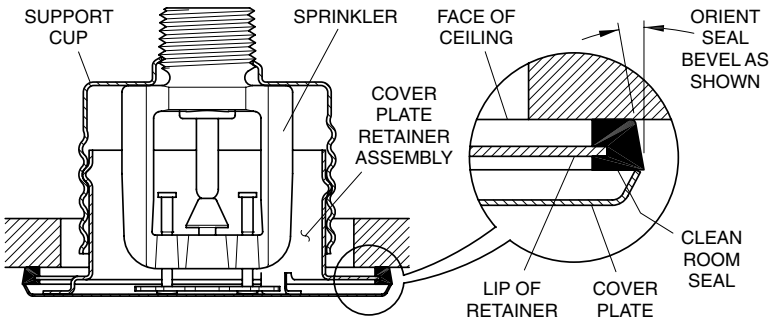


FIGURE 5
OPTIONAL AIR AND DUST SEAL FOR SERIES RFII (TY3551 & TY3504)

Limited Warranty

Products manufactured by Tyco Fire Products are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by Tyco Fire Products. No warranty is given for products or components manufactured by companies not affiliated by ownership with Tyco Fire Products or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by Tyco Fire Products to be defective shall be either repaired or replaced, at Tyco Fire Products' sole option. Tyco Fire Products neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. Tyco Fire Products shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

IN NO EVENT SHALL TYCO FIRE PRODUCTS BE LIABLE, IN CONTRACT, TORT, STRICT LIABILITY OR UNDER ANY OTHER LEGAL THEORY, FOR INCIDENTAL, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LABOR CHARGES, REGARDLESS OF WHETHER TYCO FIRE PRODUCTS WAS INFORMED ABOUT THE POSSIBILITY OF SUCH DAMAGES, AND IN NO EVENT SHALL TYCO FIRE PRODUCTS' LIABILITY EXCEED AN AMOUNT EQUAL TO THE SALES PRICE.

THE FOREGOING WARRANTY IS MADE IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Ordering Procedure

When placing an order, indicate the full product name. Contact your local distributor for availability.

Sprinkler Assembly:
Specify: (SIN), (specify temperature rating) Series RFII Concealed Pendent Sprinkler, P/N (specify).

	155F/68C	200F/93C
TY3551	51-790-1-155	51-790-1-200
TY3504	51-796-1-155	51-796-1-200
TY3531	51-792-1-155	51-792-1-200
TY3505	51-797-1-155	51-797-1-200

Separately Ordered Cover Plate:
Specify: (specify temperature rating) Series RFII Concealed Cover Plate with (specify finish), P/N (specify).

	135F/57C(a)	165F/74C*(b)
Brass	56-792-1-135	56-792-1-165
Bright Brass	56-792-2-135	56-792-2-165
Chrome	56-792-9-135	56-792-9-165
Brushed Chrome	56-792-8-135	56-792-8-165
White	56-792-0-135	56-792-0-165
White (RAL9010)*	56-792-3-135	56-792-3-165
Bright White	56-792-4-135	56-792-4-165
Off White	56-792-5-135	56-792-5-165
Black	56-792-6-135	56-792-6-165
Custom	56-792-X-135	56-792-X-165

(a) For use with 155F/68C sprinklers.
(b) For use with 200F/93C sprinklers.
* Eastern Hemisphere sales only.

Sprinkler Wrench:
Specify: RFII Sprinkler Wrench, P/N 56-000-1-075.

Air and Dust Seal:
Specify: Air and Dust Seal, P/N 56-908-1-001.

tyco / Fire & Building Products

Technical Services: Tel: (800) 381-9312 / Fax: (800) 791-5500

Series TY-FRB — 5.6 K-factor Horizontal and Vertical Sidewall Sprinklers Quick Response, Standard Coverage

General Description

The Series TY-FRB, 5.6 K-Factor, Horizontal and Vertical Sidewall Sprinklers described in this data sheet are quick response - standard coverage, decorative 3 mm glass bulb type spray sprinklers designed for use in light and ordinary hazard, commercial occupancies such as banks, hotels, shopping malls, etc. They are designed for installation along a wall or the side of a beam and just beneath a smooth ceiling. Sidewall sprinklers are commonly used instead of pendent or upright sprinklers due to aesthetics or building construction considerations, where piping across the ceiling is not desirable.

The recessed version of the Series TY-FRB Horizontal Sidewall Sprinkler is intended for use in areas with a finished wall. It uses a two-piece Style 10 Recessed Escutcheon with 1/2 inch (12,7 mm) of recessed adjustment or up to 3/4 inch (19,1 mm) of total adjustment from the flush sidewall position, or a two-piece Style 20 Recessed Escutcheon with 1/4 inch (6,4 mm) of recessed adjustment or up to 1/2 inch (12,7 mm) of total adjustment from the flush sidewall position. The adjustment provided by the Recessed Escutcheon reduces the accuracy to which the fixed pipe nipples to the sprinklers must be cut.

Corrosion resistant coatings, where applicable, are utilized to extend the life of copper alloy sprinklers beyond that which would otherwise be obtained when exposed to corrosive atmospheres. Although corrosion resistant coated sprinklers have passed the standard corrosion tests of the applicable approval agencies, the testing is not representative of all possible corrosive atmospheres. Consequently, it is recommended that the end user be consulted with respect to the suitability of these coatings for any given corrosive environment. The effects of ambient temperature, concentration of chemicals, and gas/chemical velocity, should be considered, as a minimum, along with the corrosive nature of the chemical to which the sprinklers will be exposed.

WARNINGS

The Series TY-FRB Sprinklers described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. ***Failure to do so may impair the performance of these devices.***

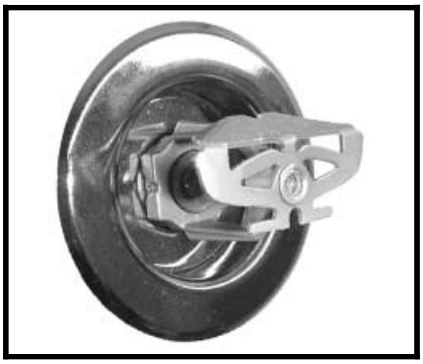
The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.

IMPORTANT

Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.

Model/Sprinkler Identification Numbers

TY3331 - Horizontal
TY3431 - Vertical



Technical Data

Approvals
UL and C-UL Listed.
FM, LPCB, and NYC Approved.
(Refer to Table A for complete approval information including corrosion resistant status.)

Maximum Working Pressure
Refer to Table B.

Discharge Coefficient
K = 5.6 GPM/psi$^{1/2}$ (80,6 LPM/bar$^{1/2}$)

Temperature Ratings
Refer to Table A.

Finishes
Sprinkler: Refer to Table A.
Recessed Escutcheon: White Coated, Chrome Plated, or Brass Plated.

K	TYPE	TEMP.	BULB LIQUID	SPRINKLER FINISH (See Note 11)			
				NATURAL BRASS	CHROME PLATED	WHITE*** POLYESTER	LEAD COATED
5.6 1/2" NPT	HORIZ. SIDEWALL (TY3331)	135°F/57°C	Orange	1, 2, 3, 4, 9, 10		1, 2, 3, 9	1, 2, 3, 9
		155°F/68°C	Red				
		175°F/79°C	Yellow				
		200°F/93°C	Green				
		286°F/141°C	Blue				
	RECESSED HORIZ. SIDEWALL (TY3331)* Figure 3	135°F/57°C	Orange	1, 2, 4, 9, 10		1, 2, 9	N/A
		155°F/68°C	Red				
		175°F/79°C	Yellow				
		200°F/93°C	Green				
	RECESSED HORIZ. SIDEWALL (TY3331)** Figure 4	135°F/57°C	Orange	1, 2, 3, 4, 9			N/A
		155°F/68°C	Red				
		175°F/79°C	Yellow				
		200°F/93°C	Green				
5.6 1/2" NPT	VERTICAL SIDEWALL (TY3431) Installed Pendent or Upright	135°F/57°C	Orange	5, 6, 7, 8, 9			5, 6, 7, 9
		155°F/68°C	Red				
		175°F/79°C	Yellow				
		200°F/93°C	Green				
		286°F/141°C	Blue				

NOTES:

1. Listed by Underwriters Laboratories, Inc. (UL) as Quick Response Sprinklers for use in Light and Ordinary Hazard Occupancies at a 4 to 12 inch (100 to 300 mm) top of deflector to ceiling distance.
2. Listed by Underwriters Laboratories Inc. for use in Canada (C-UL) as Quick Response Sprinklers for use in Light and Ordinary Hazard Occupancies at a 4 to 12 inch (100 to 300 mm) top of deflector to ceiling distance.
3. Approved by Factory Mutual Research Corporation (FM) as Quick Response Sprinklers for use in Light Hazard Occupancies at a 4 to 12 inch (100 to 300 mm) top of deflector to ceiling distance.
4. Approved by the Loss Prevention Certification Board (LPCB Ref. No. 007a/04) at a 4 to 6 inch (100 to 150 mm) top of deflector to ceiling distance. The LPC does not rate the thermal sensitivity of horizontal sidewall sprinklers.
5. Listed by Underwriters Laboratories, Inc. as Quick Response Sprinklers for use in Light and Ordinary Hazard Occupancies.
6. Listed by Underwriters Laboratories for use in Canada (C-UL) as Quick Response Sprinklers for use in Light and Ordinary Hazard Occupancies.
7. Approved by Factory Mutual Research Corporation (FM) as Quick Response Sprinklers for use in Light Hazard Occupancies.
8. Approved by the Loss Prevention Certification Board (LPCB Ref. No. 094a/06 & 007a/04) as Quick Response Sprinklers.
9. Approved by the City of New York under MEA 354-01-E.
10. Approved by the Loss Prevention Certification Board (LPCB Ref. No. 094a/06) at a 4 to 6 inch (100 to 150 mm) top of deflector to ceiling distance. The LPC does not rate the thermal sensitivity of horizontal sidewall sprinklers.
11. Where Polyester Coated and Lead Coated Sprinklers are noted to be UL and C-UL Listed, the sprinklers are UL and C-UL Listed as Corrosion Resistant Sprinklers. Where Lead Coated Sprinklers are noted to be FM Approved, the sprinklers are FM Approved as Corrosion Resistant Sprinklers.

* Installed with Style 10 (1/2" NPT) 3/4" Total Adjustment Recessed Escutcheon.
** Installed with Style 20 (1/2" NPT) 1/2" Total Adjustment Recessed Escutcheon.
*** Frame and deflector only. Listings and approvals apply to color (Special Order).

TABLE A
LABORATORY LISTINGS AND APPROVALS

Physical Characteristics

Frame . . . . . Bronze
Button . . . . . Brass/Copper
Sealing Assembly . . . . . Beryllium Nickel w/Teflon†
Bulb . . . . . Glass
Compression Screw . . . . . Bronze
HSW Deflector . . . . . Bronze
VSW Deflector . . . . . Copper

Patents

U.S.A. 5,810,263

Operation

The glass Bulb contains a fluid which expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass Bulb, allowing the sprinkler to activate and water to flow.

† DuPont Registered Trademark

K	TYPE	SPRINKLER FINISH			
		NATURAL BRASS	CHROME PLATED	WHITE POLYESTER	LEAD COATED
5.6 1/2" NPT	**HORIZONTAL SIDEWALL (TY3331)**	250 PSI (17,2 BAR) OR 175 PSI (12,1 BAR)			175 PSI (12,1 BAR)
	RECESSED HORIZ. SIDEWALL (TY3331)	(SEE NOTE 1)			N/A
	VERTICAL SIDEWALL (TY3431)	175 PSI (12,1 BAR)			

NOTES:
1. The maximum working pressure of 250 psi (17,2 bar) only applies to the Listing by Underwriters Laboratories, Inc. (UL); the Listing by Underwriters Laboratories, Inc. for use in Canada (C-UL); and, the Approval by the City of New York.

TABLE B, MAXIMUM WORKING PRESSURE

Design Criteria

The Series TY-FRB Horizontal and Vertical Sidewall Sprinklers are intended for fire protection systems designed in accordance with the standard installation rules recognized by the applicable Listing or Approval agency (e.g., UL Listing is based on the requirements of NFPA 13, and FM Approval is based on the requirements of FM's Loss Prevention Data Sheets). Only the Style 10 or 20 Recessed Escutcheon, as applicable, is to be used for recessed horizontal installations.

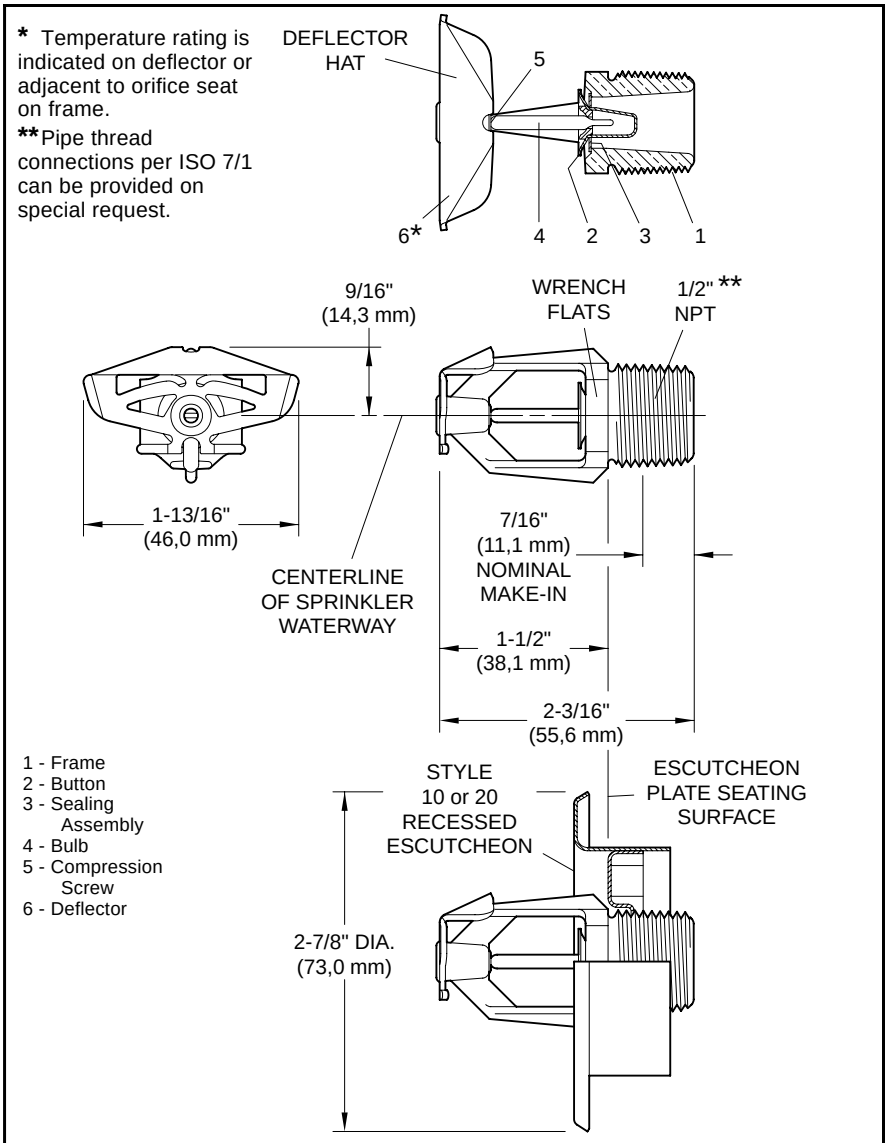


FIGURE 1
5.6 K-FACTOR QUICK RESPONSE
SERIES TY-FRB HORIZONTAL SIDEWALL (TY3331) SPRINKLERS

Installation

The Series TY-FRB Sprinklers must be installed in accordance with the following instructions:

NOTES

Do not install any bulb type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present. The diameter of the air bubble is approximately 1/16 inch (1,6 mm) for the 135°F/57°C to 3/32 inch (2,4 mm) for the 286°F/141°C temperature ratings.

A leak tight 1/2 inch NPT sprinkler joint should be obtained with a torque of 7 to 14 ft.lbs. (9,5 to 19,0 Nm). A maximum of 21 ft. lbs. (28,5 Nm) of torque may be used to install sprinklers with 1/2 NPT connections. Higher levels of torque may distort the sprinkler and cause leakage or impairment of the sprinkler.

Do not attempt to make-up for insufficient adjustment in the escutcheon plate by under- or over-tightening the sprinkler. Readjust the position of the sprinkler fitting to suit.

The **Series TY-FRB Horizontal and Vertical Sidewall Sprinklers** must be installed in accordance with the following instructions.

Step 1. Horizontal sidewall sprinklers are to be installed in the horizontal position with their centerline of waterway perpendicular to the back wall and parallel to the ceiling. The word “TOP” on the Deflector is to face towards the ceiling.

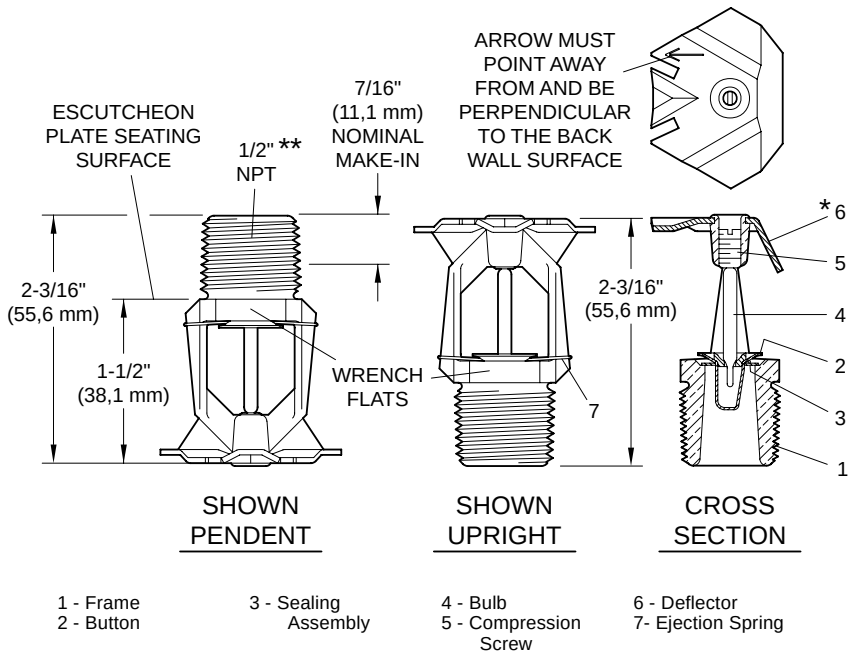
Vertical sidewall sprinklers are to be installed in the pendent or upright position with the arrow on the Deflector pointing away from the wall.

Step 2. With pipe thread sealant applied to the pipe threads, hand tighten the sprinkler into the sprinkler fitting.

Step 3. Tighten the sprinkler into the sprinkler fitting using only the W-Type 6 Sprinkler Wrench (Ref. Figure 5), With reference to Figure 1 or 2, the W-Type 6 Sprinkler Wrench is to be applied to the wrench flats.

The **Series TY-FRB Recessed Horizontal Sidewall Sprinklers** must be installed in accordance with the following instructions.

Step A. Recessed horizontal sidewall sprinklers are to be installed in the horizontal position with their centerline of waterway perpendicular to the back wall and parallel to the ceiling. The word “TOP” on the Deflector is to face towards the ceiling.



***** Temperature rating is indicated on deflector or adjacent to orifice seat on frame.

****** Pipe thread connections per ISO 7/1 can be provided on special request.

FIGURE 2
5.6 K-FACTOR QUICK RESPONSE
SERIES TY-FRB VERTICAL SIDEWALL (TY3431) SPRINKLERS

Step B. After installing the Style 10 or 20 Mounting Plate over the sprinkler threads, hand tighten the sprinkler into the sprinkler fitting.

Step C. Tighten the sprinkler into the sprinkler fitting using only the W-Type 7 Recessed Sprinkler Wrench (Ref. Figure 6). With reference to Figure 1, the W-Type 7 Recessed Sprinkler Wrench is to be applied to the sprinkler wrench flats.

Step D. After the ceiling has been installed or the finish coat has been applied, slide on the Style 10 or 20 Closure over the Series TY-FRB Sprinkler and push the Closure over the Mounting Plate until its flange comes in contact with the ceiling

Care and Maintenance

The Series TY-BFR Sprinklers must be maintained and serviced in accordance with the following instructions:

NOTES

Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, permission to shut down the affected fire protection system must be obtained from the proper authorities and all personnel who may be affected by this action must be notified.

The owner must assure that the sprinklers are not used for hanging of any objects; otherwise, non-operation in the event of a fire or inadvertent operation may result.

Absence of an escutcheon, which is used to cover a clearance hole, may delay the time to sprinkler operation in a fire situation.

Sprinklers that are found to be leaking or exhibiting visible signs of corrosion

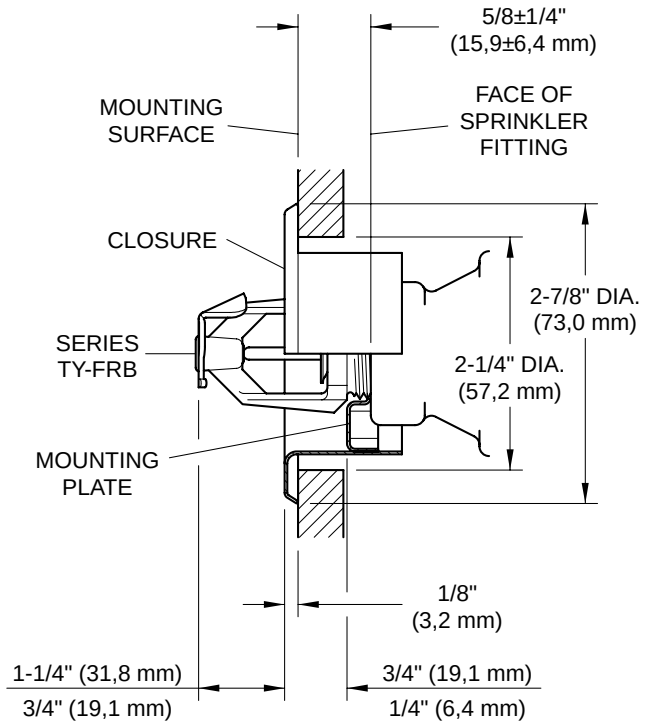


FIGURE 3
SERIES TY-FRB RECESSED HORIZONTAL SIDEWALL SPRINKLER WITH TWO-PIECE 3/4 INCH TOTAL ADJUSTMENT STYLE 10 RECESSED ESCUTCHEON

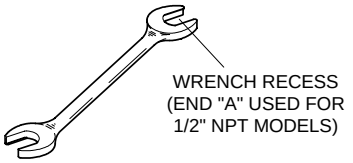


FIGURE 5
W-TYPE 6 SPRINKLER WRENCH

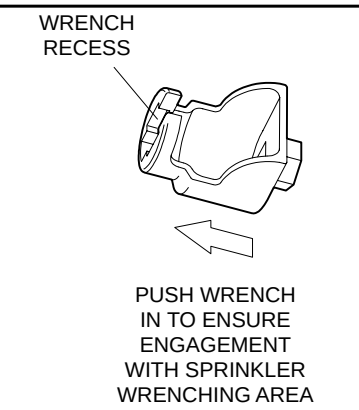


FIGURE 6
W-TYPE 7 RECESSED SPRINKLER WRENCH

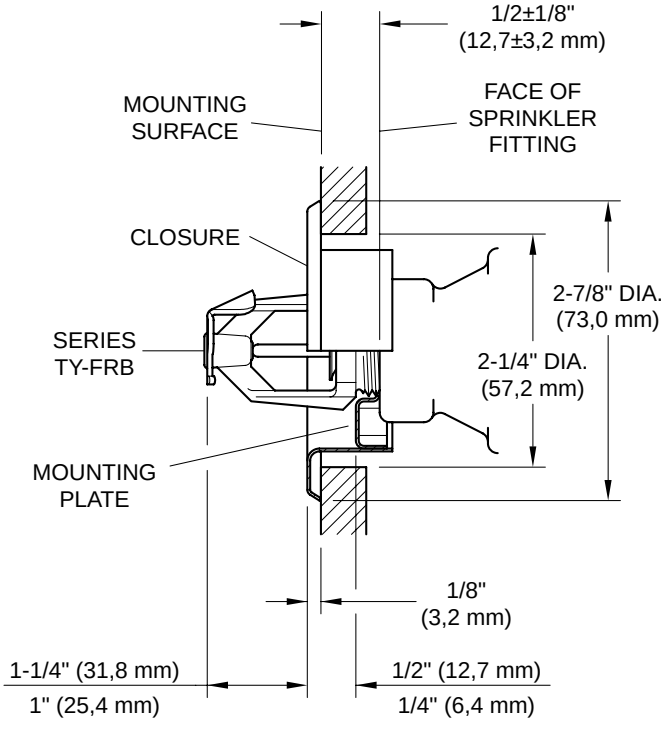


FIGURE 4
SERIES TY-FRB RECESSED HORIZONTAL SIDEWALL SPRINKLER WITH TWO-PIECE 1/2 INCH TOTAL ADJUSTMENT STYLE 20 RECESSED ESCUTCHEON

must be replaced.

Automatic sprinklers must never be painted, plated, coated or otherwise altered after leaving the factory. Modified sprinklers must be replaced. Sprinklers that have been exposed to corrosive products of combustion, but have not operated, should be replaced if they cannot be completely cleaned by wiping the sprinkler with a cloth or by brushing it with a soft bristle brush.

Care must be exercised to avoid damage to the sprinklers - before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb. (Ref. Installation Section).

Frequent visual inspections are recommended to be initially performed for corrosion resistant coated sprinklers, after the installation has been completed, to verify the integrity of the corrosion resistant coating. Thereafter, annual inspections per NFPA 25 should suffice; however, instead of inspecting from the floor level, a random sampling of close-up visual inspections should be made, so as to better determine the exact sprinkler condition and the long term integrity of the

P/N 57 — XXX — X — XXX

		MODEL/SIN
378	HORIZONTAL SIDEWALL	TY3331
375	VERTICAL SIDEWALL	TY3431

	SPRINKLER
1	NATURAL BRASS
4	WHITE POLYESTER
3	WHITE RAL9010)*
9	CHROME PLATED
7	LEAD COATED

	TEMPERATURE RATING
135	135°F/57°C
155	155°F/68°C
175	175°F/79°C
200	200°F/93°C
286	286°F/141°C

* Eastern Hemisphere sales only.

TABLE C
PART NUMBER SELECTION
SERIES TY-FRB HORIZONTAL AND VERTICAL SIDEWALL SPRINKLERS

corrosion resistant coating, as it may be affected by the corrosive conditions present.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any other authorities having jurisdiction. The installing contractor or sprinkler manufacturer should be contacted relative to any questions.

It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

Limited Warranty

Products manufactured by Tyco Fire & Building Products (TFBP) are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by TFBP. No warranty is given for products or components manufactured by companies not affiliated by ownership with TFBP or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by TFBP to be defective shall be either repaired or replaced, at TFBP's sole option. TFBP neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. TFBP shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

In no event shall TFBP be liable, in contract, tort, strict liability or under any other legal theory, for incidental, indirect, special or consequential damages, including but not limited to labor charges, regardless of whether TFBP was informed about the possibility of such damages, and in no event shall TFBP's liability exceed an amount equal to the sales price.

The foregoing warranty is made in lieu of any and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

This limited warranty sets forth the exclusive remedy for claims based on failure of or defect in products, materials or components, whether the claim is made in contract, tort, strict liability or any other legal theory.

This warranty will apply to the full extent permitted by law. The invalidity, in whole or part, of any portion of this warranty will not affect the remainder.

Ordering Procedure

When placing an order, indicate the full product name. Refer to the Price List for complete listing of Part Numbers.

Contact your local distributor for availability.

Sprinkler Assemblies with NPT Thread Connections:
Specify: (Specify Model/SIN), Quick Response, (specify K-factor), (specify temperature rating), Series TY-FRB (specify Horizontal Sidewall or Vertical Sidewall) Sprinkler with (specify type of finish or coating), P/N (specify from Table C).

Recessed Escutcheon:
Specify: Style (10 or 20) Recessed Escutcheon with (specify*) finish, P/N (specify*).

* Refer to Technical Data Sheet TFP770.

Sprinkler Wrench:
Specify: W-Type 6 Sprinkler Wrench, P/N 56-000-6-387.

Specify: W-Type 7 Sprinkler Wrench, P/N 56-850-4-001.

tyco / Fire & Building Products

Technical Services: Tel: (800) 381-9312 / Fax: (800) 791-5500

Series EC-11 & EC-14 — 11.2 and 14.0 K-factor Extended Coverage (Light and Ordinary Hazard) Upright, Pendent, and Rec. Pendent Sprinklers

General Description

The Series EC-11 and EC-14 Extended Coverage Upright and Pendent Sprinklers are decorative glass bulb sprinklers designed for use in light or ordinary hazard occupancies. They are intended for use in automatic sprinkler systems designed in accordance with standard installation rules (e.g., NFPA 13) for a maximum coverage area of 400 ft^2 (37,2 m^2), as compared to the maximum coverage area of 130 ft^2 (12,1 m^2) for standard coverage sprinklers used in ordinary hazard occupancies or 225 ft^2 (20,6 m^2) for standard coverage sprinklers used in light hazard occupancies.

The Series EC-11 and EC-14 Sprinklers feature a UL and C-UL Listing that permits their use with unobstructed or non-combustible obstructed ceiling construction as defined and permitted by NFPA 13, as well as a specific application listing for use under concrete tees.

The Series EC-11 and EC-14 Extended Coverage Sprinklers have been fire tested to compare their performance to that of standard coverage spray sprinklers. These tests have shown that the protection provided is equal to or more effective than standard coverage spray sprinklers.

IMPORTANT

Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.

Corrosion resistant coatings, where applicable, are utilized to extend the life of copper alloy sprinklers beyond that which would otherwise be obtained when exposed to corrosive atmospheres. Although corrosion resistant coated sprinklers have passed the standard corrosion tests of the applicable approval agencies, the testing is not representative of all possible corrosive atmospheres. Consequently, it is recommended that the end user be consulted with respect to the suitability of these corrosion resistant coatings for any given corrosive environment. The effects of ambient temperature, concentration of chemicals, and gas/chemical velocity, should be considered, as a minimum, along with the corrosive nature of the chemical to which the sprinklers will be exposed.

WARNINGS

The Series EC-11 and EC-14 Extended Coverage Sprinklers described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. ***Failure to do so may impair the performance of these devices.***

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.

Model/Sprinkler Identification Number

TY5137 - Upright, 11.2K
TY5237 - Pendent, 11.2K
TY6137 - Upright, 14.0K
TY6237 - Pendent,14.0K

TY5137 is a redesignation for C5137, G1894, and S2510.

TY5237 is a redesignation for C5237, G1893, and S2511.

TY6137 is a redesignation for C6137, G1896, and S2610.

TY6237 is a redesignation for C6237, G1895, and S2611.

1 - Frame
2 - Button
3 - Sealing Assembly
4 - Bulb
5 - Compression Screw
6 - Deflector*

* Temperature rating is indicated on deflector

** Pipe thread connections per ISO 7/1 can be provided on special request.

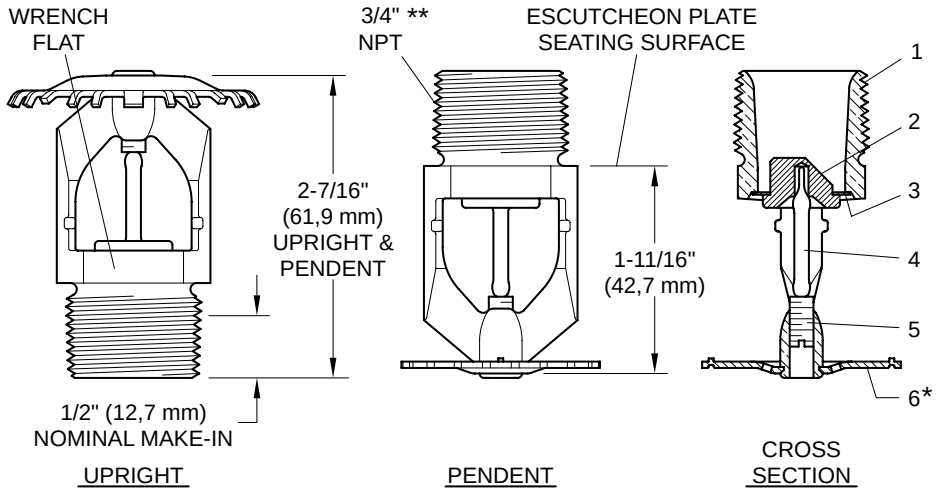


FIGURE 1
SERIES EC-11 AND EC-14 EXTENDED COVERAGE SPRINKLERS
11.2 K-FACTOR (TY5137) UPRIGHT AND (TY5237) PENDENT
14.0 K-FACTOR (TY6137) UPRIGHT AND (TY6237) PENDENT

				SPRINKLER FINISH (See Note 5)			
HAZARD	**TYPE**	**TEMP.**	**BULB LIQUID**	**NATURAL BRASS**	**CHROME PLATED**	**WHITE* POLYESTER**	**LEAD COATED**
LIGHT **Refer to Table B for UL and C-UL Sensitivity Rating and Refer to Table C for FM Sensitivity Rating**	**UPRIGHT K=11.2 (TY5137) PENDENT K=11.2 (TY5237) K=14.0 (TY6237)**	135°F/57°C	Orange	1, 2, 3**, 4			
		155°F/68°C	Red				
		175°F/79°C	Yellow	1, 2, 4			1, 2, 4
		200°F/93°C	Green				
		286°F/141°C	Blue				
	REC. PENDENT K=11.2 (TY5237) K=14.0 (TY6237) With Style 30 Escutcheon	135°F/57°C	Orange	1, 2, 3, 4			N/A
		155°F/68°C	Red				
		175°F/79°C	Yellow	1, 2, 4			
		200°F/93°C	Green				
		286°F/141°C	Blue				
ORDINARY **Refer to Table B for UL and C-UL Sensitivity Rating and Refer to Table C for FM Sensitivity Rating**	**UPRIGHT K=11.2 (TY5137) K=14.0 (TY6137) and PENDENT K=11.2 (TY5237) K=14.0 (TY6237)**	135°F/57°C	Orange	1, 2, 3, 4			1, 2, 3, 4
		155°F/68°C	Red				
		175°F/79°C	Yellow				1, 2, 4
		200°F/93°C	Green				
		286°F/141°C	Blue				
	REC. PENDENT K=11.2 (TY5237) K=14.0 (TY6237) With Style 40 Escutcheon	135°F/57°C	Orange	1, 2, 4			N/A
		155°F/68°C	Red				
		175°F/79°C	Yellow				
		200°F/93°C	Green				

NOTES:
1.Listed by Underwriters Laboratories, Inc. (UL).
2.Listed by Underwriters Laboratories, Inc. for use in Canada (C-UL).
3. Approved by Factory Mutual Research Corporation (FM).
4. Approved by the City of New York under MEA 177-03-E.
5. Where Polyester Coated or Lead Coated Sprinklers are noted to be UL and C-UL Listed, the sprinklers are UL and C-UL Listed as Corrosion Resistant Sprinklers.
*Frame and Deflector only. Listings and approvals apply to color (Special Order).
** Pendent Only.
N/A: Not Available

TABLE A, LABORATORY LISTINGS AND APPROVALS

AREA	STYLE	LIGHT HAZARD 135°F	155°F	175°F	200°F	286°F	ORDINARY HAZARD 135°F	155°F	175°F	200°F	286°F
14 x 14	Up. or Pend.	—	—	—	—	—	QR	QR	QR	QR	SR
14 x 14	Style 30 Recessed	—	—	—	—	—	QR	QR	QR	QR	N/A
14 x 14	Style 40 Recessed	—	—	—	—	—	QR	QR	QR	QR	N/A
16 x 16	Up. or Pend.	QR*	QR*	QR*	QR*	QR*	SR	SR	SR	SR	SR
16 x 16	Style 30 Recessed	QR*	QR*	QR*	QR*	QR*	SR	SR	SR	SR	N/A
16 x 16	Style 40 Recessed	N/A	N/A	N/A	N/A	N/A	SR	SR	SR	SR	N/A
18 x 18	Up. or Pend.	QR*	QR*	QR*	QR*	QR*	SR	SR	SR	SR	SR
18 x 18	Style 30 Recessed	QR*	QR*	QR*	QR*	QR*	SR	SR	SR	SR	N/A
18 x 18	Style 40 Recessed	N/A	N/A	N/A	N/A	N/A	SR	SR	SR	SR	N/A
20 x 20	Up. or Pend.	QR*	QR*	QR*	SR*	SR*	SR	SR	SR	SR	SR
20 x 20	Style 30 Recessed	QR*	SR*	QR*	SR*	SR*	SR	SR	SR	SR	N/A
20 x 20	Style 40 Recessed	N/A	N/A	N/A	N/A	N/A	SR	SR	SR	SR	N/A

QR: Quick Response
SR: Standard Response
N/A: Not Applicable
* Does not apply to Upright K = 14.0

TABLE B
SENSITIVITY RATING FOR UL AND C-UL LISTING OF SERIES EC-11 OR EC-14 SPRINKLERS
(SEE TABLE D FOR PERMITTED K-FACTOR/AREA COMBINATIONS)

AREA	STYLE	LIGHT HAZARD 135°F	155°F	175°F	200°F	286°F	ORDINARY HAZARD 135°F	155°F	175°F	200°F	286°F
14 x 14	Up. or Pend.	—	—	—	—	—	SR	SR	SR	SR	SR
14 x 14	Style 30 Recessed	—	—	—	—	—	N/A	N/A	N/A	N/A	N/A
14 x 14	Style 40 Recessed	—	—	—	—	—	N/A	N/A	N/A	N/A	N/A
16 x 16	Up. or Pend.	QR*	QR*	N/A	N/A	N/A	SR	SR	SR	SR	SR
16 x 16	Style 30 Recessed	QR	QR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
16 x 16	Style 40 Recessed	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18 x 18	Up. or Pend.	QR*	QR*	N/A	N/A	N/A	SR	SR	SR	SR	SR
18 x 18	Style 30 Recessed	QR	QR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18 x 18	Style 40 Recessed	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
20 x 20	Up. or Pend.	QR*	QR*	N/A	N/A	N/A	SR	SR	SR	SR	SR
20 x 20	Style 30 Recessed	QR	QR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
20 x 20	Style 40 Recessed	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

QR: Quick Response
SR: Standard Response
N/A: Not Applicable
* Pendent Only

TABLE C
SENSITIVITY RATING FOR FM APPROVAL OF SERIES EC-11 OR EC-14 SPRINKLERS
(SEE FM LOSS PREVENTION DATA SHEET 2-8N FOR PERMITTED K-FACTOR/AREA COMBINATIONS)

Technical Data

Approvals
UL and C-UL Listed. FM Approved. (Refer to Table A for complete approval information including corrosion resistant status. The approvals apply to the service conditions indicated in the Design Criteria section.)

Maximum Working Pressure
175 psi (12,1 bar)

Pipe Thread Connection
3/4 inch NPT

Discharge Coefficients
K = 11.2 GPM/psi$^{1/2}$
(161,3 LPM/bar$^{1/2}$)
K = 14.0 GPM/psi$^{1/2}$
(201,6 LPM/bar$^{1/2}$)

Temperature Ratings
135°F/57°C to 286°F/141°C

Finish
Sprinkler: Refer to Table A
Recessed Escutcheon: White Coated, Chrome Plated, and Brass Plated

Physical Characteristics

Frame	Bronze
Button	Bronze
Sealing Assembly	Beryllium Nickel w/Teflon†
Bulb	Glass (3 mm dia.)
Compression Screw	Bronze
Deflector	Brass

Patents
U.S.A. Patent Numbers 5,366,022; 5,579,846; 5,584,344; 5,609,211; 5,862,994; and 5,865,256.

Operation

The glass bulb contains a fluid which expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass bulb, which then allows the sprinkler to activate and flow water.

Design Criteria

The Series EC-11 and EC-14 Extended Coverage Sprinklers must only be installed in accordance with the applicable UL and C-UL Listing or FM Approval requirements as indicated below. Only the Style 30 or 40 Recessed Escutcheon is to be used for recessed installation, as applicable (Ref. Table A, B, and C).

UL and C-UL Listing Requirements

1. The Series EC-11 and EC-14 Sprinklers may be used for the coverage areas shown in Table D, based on maintaining the minimum specified flow rate as a function of coverage area and hazard group for all of the sprinklers in the design area.

2. The Series EC-11 and EC-14 Sprinklers are permitted to be used with unobstructed or non-combustible obstructed ceiling construction as defined and permitted by NFPA 13. For example:

   Unobstructed, combustible or non-combustible, ceiling construction with a deflector to ceiling/roof deck distance of 1 to 12 inches (25 to 300 mm).

   Obstructed, non-combustible, ceiling construction with a deflector location below structural members of 1 to 6 inches (25 to 150 mm) and a maximum deflector to ceiling/roof deck distance of 22 inches (550 mm).

3. The Series EC-11 and EC-14 Sprinklers having been specifically tested and listed for non-combustible obstructed construction are permitted to be used within trusses or bar joists having non-combustible web members greater than 1 inch (25.4 mm) when applying the 4 times obstruction criteria rule defined under “Obstructions to Sprinkler Discharge Pattern Development”.

4. The minimum allowable spacing between the Series EC-11 and EC-14 Sprinklers, to prevent cold soldering, is 8 feet (2,4 m) for upright sprinklers and 9 feet (2,7 m) for pendent sprinklers.

5. The Series EC-11 and EC-14 Sprinklers are to be installed in accordance with all other requirements of NFPA 13 for extended coverage upright and pendent sprinklers. For example: obstructions to sprinkler discharge, obstructions to sprinkler pattern development, obstructions to prevent sprinkler discharge from reaching hazard, clearance to storage, etc.

UL and C-UL Specific Application Listing Requirements For Installation Under Concrete Tees
The Series EC-11 and EC-14 Extended Coverage Upright and Pendent Sprinklers (TY5137, TY5237, TY6137 & TY6237) have a UL and C-UL Specific Application Listing for use under concrete tees when installed as follows:

1. The stems of the concrete tee construction must spaced at less than 7.5 feet (2,3 m) on center but more than 3 feet (0,9 m) on center. The depth of the concrete tees must not exceed 30 inches (762 mm). The maximum permitted concrete tee length is 32 feet (9,8 m); however, where the concrete tee length exceeds 32 feet (9,8 m), non-combustible baffles, equal in height to the depth of the tees, can be installed so that the space between the tees does not exceed 32 feet (9,8 m) in length.

2. The sprinkler deflectors are to be located in a horizontal plane at or above 1 inch (25,4 mm) below the bottom of the concrete tee stems.

3. When the sprinkler deflectors are located higher than a horizontal plane 1 inch (25l,4 mm) beneath the bottom of the concrete tee stems, the obstruction to sprinkler discharge criteria requirements of NFPA 13 for extended coverage upright sprinklers applies.

FM Approval Requirements
The Series EC-11 and EC-14 Extended Coverage Sprinklers are to be installed in accordance with the applicable Factory Mutual Loss Prevention Data Sheet for limited use in buildings of specific roof construction and for the protection of certain specific ordinary hazard (non-storage and/or non-flammable or combustible liquid) occupancies. Information provided in the FM Loss Prevention Data Sheets relate to, but are not limited to, hydraulic design, ceiling slope and obstructions, minimum and maximum allowable spacing, and deflector-to ceiling distance.

These criteria may differ from UL and/or NFPA criteria, therefore the designer should review and become familiar with Factory Mutual requirements before proceeding with design.

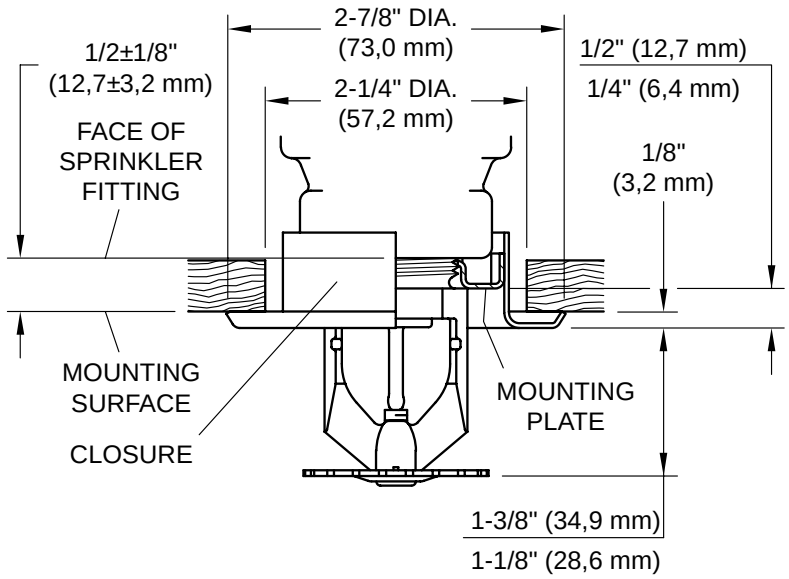


FIGURE 2
SERIES EC-11 AND EC-14 RECESSED PENDENT SPRINKLER ASSEMBLY WITH TWO-PIECE 1/2 INCH TOTAL ADJUSTMENT STYLE 30 RECESSED ESCUTCHEON

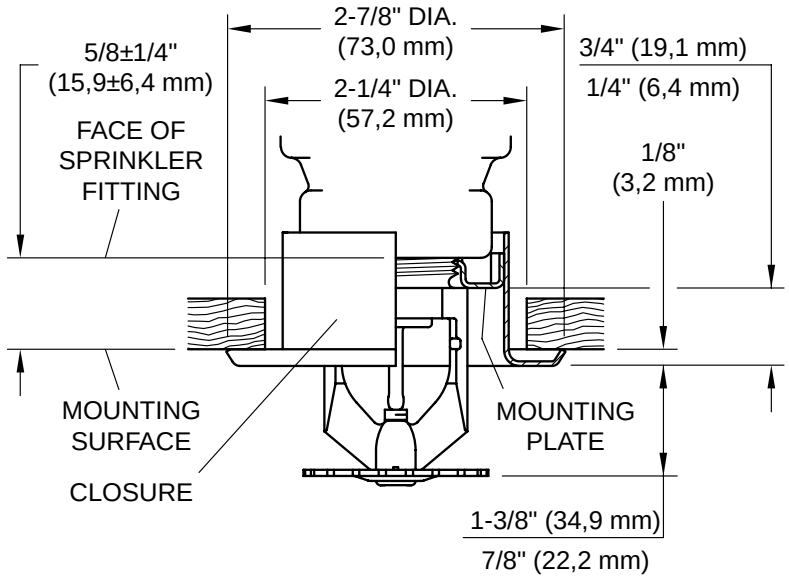


FIGURE 3
SERIES EC-11 AND EC-14 RECESSED PENDENT SPRINKLER ASSEMBLY WITH TWO-PIECE 3/4 INCH TOTAL ADJUSTMENT STYLE 40 RECESSED ESCUTCHEON

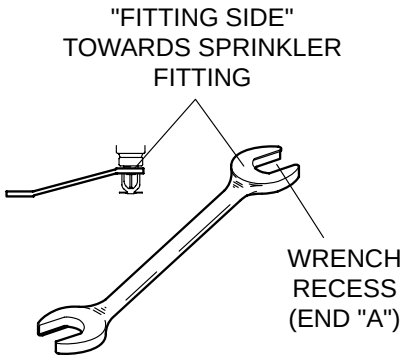


FIGURE 4
W-TYPE 3 SPRINKLER WRENCH

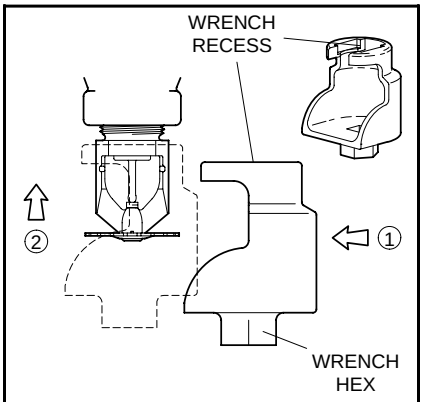


FIGURE 5
W-TYPE 22 RECESSED SPRINKLER WRENCH

		LIGHT HAZARD 0.10 GPM/FT^2		GROUP I ORDINARY HAZARD 0.15 GPM/FT^2		GROUP II ORDINARY HAZARD 0.20 GPM/FT^2	
DESCRIPTION	**AREA**	**GPM**	**PSI**	**GPM**	**PSI**	**GPM**	**PSI**
TY5137 (K=11.2) UPRIGHT	14 x 14	—	—	30	7.2	39	12.1
	16 x 16	30	7.2	39	12.1	51	20.7
	18 x 18	33	8.7	49	19.1	65	33.7
	20 x 20	40	12.8	60	28.7	80	51.0
TY5237 (K=11.2) PENDENT	14 x 14	—	—	30	7.2	39	12.1
	16 x 16	30	7.2	39	12.1	51	20.7
	18 x 18	33	8.7	49	19.1	65	33.7
	20 x 20	40	12.8	60	28.7	80	51.0
TY6137 (K=14.0) UPRIGHT	14 x 14	N/A	N/A	—	—	—	—
	16 x 16	N/A	N/A	39	7.8	51	13.3
	18 x 18	N/A	N/A	49	12.3	65	21.6
	20 x 20	N/A	N/A	60	18.4	80	32.7
TY6237 (K=14.0) PENDENT	14 x 14	—	—	—	—	—	—
	16 x 16	37	7.0	39	7.8	51	13.3
	18 x 18	37	7.0	49	12.3	65	21.6
	20 x 20	40	8.2	60	18.4	80	32.7

1 ft. = 0.3048 m
1 ft^2 = 0.093 m^2
1 gpm = 3.785 lpm
1 psi = 0.06895 bar
1 gpm/ft^2 = 40.74 mm/min

TABLE D
FLOW CRITERIA FOR UL AND C-UL LISTING OF SERIES EC-11 AND EC-14 SPRINKLERS

Installation

The Series EC-11 and EC-14 Sprinklers must be installed in accordance with the following instructions:

NOTES

Do not install any bulb type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present. The diameter of the air bubble is approximately 1/16 inch (1,6 mm) for the 135°F/57°C to 3/32 inch (2,4 mm) for the 286°F/141°C temperature ratings.

A leak tight 3/4 inch NPT sprinkler joint should be obtained with a torque of 10 to 20 ft.lbs. (13,4 to 26,8 Nm). A maximum of 30 ft.lbs. (40.7 Nm) of torque is to be used to install sprinklers. Higher levels of torque may distort the sprinkler inlet with consequent leakage or impairment of the sprinkler.

Do not attempt to compensate for insufficient adjustment in an Escutcheon Plate by under- or over-tightening the Sprinkler. Readjust the position of the sprinkler fitting to suit.

Step 1. The sprinkler must be installed with the deflector parallel to the mounting surface. Pendent sprinklers must be installed in the pendent position, and upright sprinklers must be installed in the upright position.

Step 2. After installing the Style 30 or 40 mounting plate (or other escutcheon, as applicable) over the sprinkler pipe threads and with pipe thread sealant applied to the pipe threads, hand tighten the sprinkler into the sprinkler fitting.

Step 3. Wrench tighten upright or pendent sprinklers using only the W-Type 3 (End A) Sprinkler Wrench. Wrench tighten the recessed pendent sprinklers using only the W-Type 22 Sprinkler Wrench. The wrench recess of the applicable sprinkler wrench (Ref. Figure 4 and 5) is to be applied to the sprinkler wrench flats (Ref. Figure 1).

Care and Maintenance

The Series EC-11 and EC-14 Sprinklers must be maintained and serviced in accordance with the following instructions:

NOTE

Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, permission to shut down the affected fire protection systems must be obtained from the proper authorities and all personnel who may be affected by this action must be notified.

Sprinklers that are found to be leaking or exhibiting visible signs of corrosion must be replaced.

Automatic sprinklers must never be painted, plated, coated, or otherwise altered after leaving the factory. Modified sprinklers must be replaced. Sprinklers that have been exposed to corrosive products of combustion, but have not operated, should be replaced if they cannot be completely cleaned by wiping the sprinkler with a cloth or by brushing it with a soft bristle brush.

Care must be exercised to avoid damage to the sprinklers - before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb. (Ref. Installation Section).

Frequent visual inspections are recommended to be initially performed for corrosion resistant coated sprinklers, after the installation has been completed, to verify the integrity of the corrosion resistant coating. Thereafter, annual inspections per NFPA 25 should suffice; however, instead of inspecting from the floor level, a random sampling of close-up visual inspections should be made, so as to better determine the exact sprinkler condition and the long term integrity of the corrosion resistant coating, as it may be affected by the corrosive conditions present.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any other authorities having jurisdiction. The installing contractor or sprinkler manufacturer should be contacted relative to any questions.

It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

Limited Warranty

Products manufactured by Tyco Fire & Building Products (TFBP) are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by TFBP. No warranty is given for products or components manufactured by companies not affiliated by ownership with TFBP or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by TFBP to be defective shall be either repaired or replaced, at TFBP's sole option. TFBP neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. TFBP shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

In no event shall TFBP be liable, in contract, tort, strict liability or under any other legal theory, for incidental, indirect, special or consequential damages, including but not limited to labor charges, regardless of whether TFBP was informed about the possibility of such damages, and in no event shall TFBP's liability exceed an amount equal to the sales price.

The foregoing warranty is made in lieu of any and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

This limited warranty sets forth the exclusive remedy for claims based on failure of or defect in products, materials or components, whether the claim is made in contract, tort, strict liability or any other legal theory.

This warranty will apply to the full extent permitted by law. The invalidity, in whole or part, of any portion of this warranty will not affect the remainder.

Ordering Procedure

When placing an order, indicate the full product name. Please specify the Sprinkler Identification Number (SIN), quantity, and temperature rating. Refer to the Price List for complete listing of Part Numbers.

Contact your local distributor for availability.

Sprinkler Assemblies with NPT Thread Connections:
Specify: (specify SIN), (specify K-Factor), (specify temperature rating), (specify Pendent or Upright) Extended Coverage Sprinkler with (specify finish), P/N (specify - from Table E, where applicable).

Recessed Escutcheon:
Specify: Style (specify 30 or 40) Recessed Escutcheon with (specify finish), P/N (specify).

Style 30 Recessed Escutcheon
Chrome Plated . . . . . PSN 56-705-9-011
White Color Coated . . . . . PSN 56-705-4-011
White (RAL9010)* . . . . . PSN 56-705-3-011
Brass Plated . . . . . PSN 56-705-2-011

Style 40 Recessed Escutcheon
Chrome Plated . . . . . PSN 56-700-9-010
White Color Coated . . . . . PSN 56-700-4-010
White (RAL9010)* . . . . . PSN 56-700-3-010
Brass Plated . . . . . PSN 56-700-2-010

*Eastern Hemisphere sales only.

Sprinkler Wrench:
Specify: W-Type 3 Sprinkler Wrench, P/N 56-895-1-001

Specify: W-Type 22 Recessed Sprinkler Wrench, P/N 56-665-7-001

P/N 51 - AAA - B -CCC

AAA = 893 (for TY5237 K11.2 Pendent)
AAA = 894 (for TY5137 K11.2 Upright)
AAA = 895 (for TY6237 K14.0 Pendent)
AAA = 896 (for TY6137 K14.0 Upright)

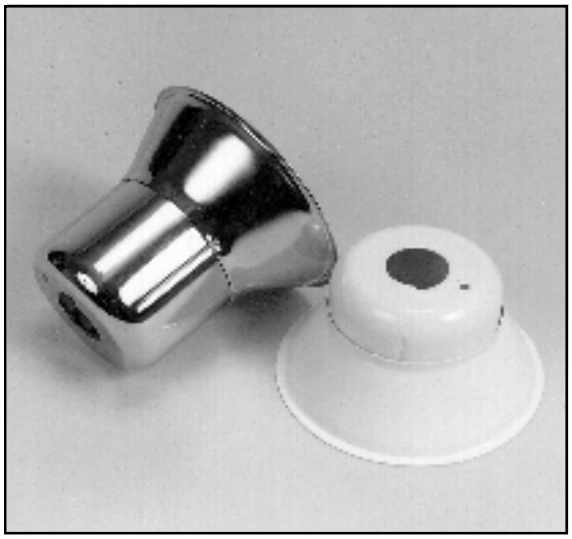
B = 1 (for Natural Brass)
B = 3 (for White [RAL9010])*
B = 4 (for White Polyester)
B = 7 (for Lead Coated
B = 9 (for Chrome Plated)

CCC = 135 (for 135°F/57°C)
CCC = 155 (for 155°F/68°C)
CCC = 175 (for 175°F/79°C)
CCC = 200 (for 200°F/93°C)

*Eastern Hemisphere sales only.

TABLE E
PART NUMBERS FOR
EC-11 AND EC-14 SPRINKLERS

2-pc Adjustable Sprinkler Escutcheon



Manufactured by: Fire Protection Products, Inc
6241 Yarrow Dr., Suite A, Carlsbad, CA 92009-1541

Description

The two-piece adjustable sprinkler escutcheon (canopy) has been designed to provide an aesthetically pleasing concealment of the sprinkler piping, servicing the individual sprinkler head.

The sprinkler escutcheon (canopy) has a full 2" of field adjustment, making it possible to accommodate minor irregularities in ceiling to sprinkler head location. This assures complete concealment of the ceiling penetration allowing only the sprinkler to be exposed. Additionally the skirt is manufactured with two raised reliefs allowing for increased friction between the two parts when installed. This sprinkler escutcheon (canopy) is available in two standard thread sizes and four standard finishes. Special threads (openings) and finishes are available.

Installation

Proper installation of the sprinkler escutcheon can be accomplished with tools ordinarily found on the job site. The installer must make sure that the reducing coupling on the drop nipple does not exceed 2" outside diameter. The face of the coupling must extend at least 1.85" but not more than 2.85" past the finished ceiling. Turn the escutcheon cup onto the sprinkler threads then install the sprinkler into the reducing coupling using the manufacturers sprinkler installation instructions. After the finished ceiling is installed, push the skirt over the cup so that it is flush against the ceiling. Upon system activation, leaks can be detected by observing accumulation of moisture at the "weep" hole.

FPPI®

Specs:

Type:2-pc Adjustable w/ weep hole

Standard threads:
1/2" or 3/4" IPS

Material:
.020" cold rolled steel

Standard finishes:
Chrome
Brass
White
Off white

Depth:
Min. 2"
Max. 3"

Base coverage:
3.5"

For questions:
1 800 344-1822 or fax
1 800 344-3775

tyco / Fire & Building Products

Technical Services: Tel: (800) 381-9312 / Fax: (800) 791-5500

Model G1 & G4 Sprinkler Guards
Model G1/S1 & G4/S3 Guards with Shields
Series TY-B, TY-FRB, TY-L, and TY-FRL Sprinklers

General Description

The Model G1 & G4 Sprinkler Guards (Ref. Figure 1) are designed for use with specific types of Series TY-B, TY-FRB, TY-L, and TY-FRL Sprinklers that may be located in areas that make them susceptible to mechanical or physical damage. Table A provides compatibility details.

The Model G1/S1 & G4/S3 Sprinkler Guards with Shields (Ref. Figure 2), in addition to providing protection from mechanical or physical damage, shields the sprinkler from water spray of higher elevation sprinklers (e.g., rack storage sprinkler installations). When the G1/S1 and G4/S3 are used with the Series TY-B, TY-FRB, TYL, and TY-FRL Sprinklers shown in Table A, the assemblies form Upright Intermediate Level Sprinklers intended for use in fire sprinkler systems designed in accordance with the standard installation rules recognized by the applicable Listing agency (i.e., UL Listing is based on NFPA requirements).

The G1 and G4 are a redesignation for the Gem F938 & F937, and the G1/S1 & G4/S3 are a redesignation for the Gem F938/Q-76 and F937/Q-75.

WARNINGS

The Model G1 & G4 Sprinkler Guards and G1/S1 & G4/S3 Sprinkler Guards with Shields described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. Failure to do so may impair the integrity of these devices.

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or manufacturer should be contacted relative to any questions.

Technical Data

Approvals
UL and C-UL Listed. FM Approved. (Refer to Table A)

Finishes
Red Painted and Zinc Chromate

Physical Characteristics
Welded assembly fabricated from carbon steel

Design Criteria

In accordance with the requirements of the NFPA, sprinkler guards shall be listed. Guards are only listed for use with specified sprinklers; therefore, the G1, G4, G1/S1, and G4/S3 must only be used with the Series TY-B, TY-FRB, TY-L, and TY-FRL Sprinklers shown in Table A.

Installation

The Models G1, G4, G1/S1, and G4/S3 are to be installed as follows:

Step 1. The G1, G4, G1/S1, or G4/S3 is to be mounted on the sprinkler after the sprinkler has been installed in accordance with its applicable technical data sheet.

Step 2. With the Clips loose, first spread the two halves of the Sprinkler Guard just enough to pass by the sprinkler deflector from the side. Then, once again spread the two halves of the Sprinkler Guard just enough to pass over the sprinkler **"thread relief"** or **"wrenching area"**, as applicable, portion of the sprinkler. (Refer to Table A, as well as Figures 1 and 2.)

Step 3. With the Sprinkler Guard positioned on the **"thread relief"** or **"wrenching area"** portion of the sprinkler, as applicable, engage the Clips and then slide the Clips until they

G1

G4

G1/S1

G4/S3

SERIES SPRINKLER	TFP SIN	GEM SIN	STAR SIN	SPRINKLER TYPE	SPRINKLER K-FACTOR	MOUNTING LOCATION	GUARD MODEL (APPROVALS)	GUARD WITH SHIELD MODEL (APPROVALS)
TY-B	TY1151	G7530	–	Upright	2.8	Thread Relief	G1 (1)	N/A
	TY1251	G7531	–	Pendent	2.8	Thread Relief	G1 (1)	N/A
	TY3151	G7570	–	Upright	5.6	Thread Relief	G1 (1, 2)	G1/S1 (1)
	TY3251	G7571	–	Pendent	5.6	Thread Relief	G1 (1, 2)	N/A
	TY4851	G7560	–	Upright	8.0 (1/2" NPT)	Thread Relief	G1 (1, 2)	N/A
	TY4951	G7561	–	Pendent	8.0 (1/2" NPT)	Thread Relief	G1 (1, 2)	N/A
	TY4151	G7590	–	Upright	8.0 (3/4" NPT)	Thread Relief	G1 (1, 2)	G1/S1 (1)
	TY4251	G7591	–	Pendent	8.0 (3/4" NPT)	Thread Relief	G1 (1, 2)	N/A
	TY3351	G7578	–	HSW	5.6	Thread Relief	G4 (1)	N/A
	TY3451	G7575	–	VSW	5.6	Thread Relief	G4 (1)	N/A
TY-FRB	TY1131	G7330	–	Upright	2.8	Thread Relief	G1 (1)	N/A
	TY1231	G7331	–	Pendent	2.8	Thread Relief	G1 (1)	N/A
	TY3131	G7370	–	Upright	5.6	Thread Relief	G1 (1, 2)	G1/S1 (1)
	TY3231	G7371	–	Pendent	5.6	Thread Relief	G1 (1, 2)	N/A
	TY4131	G7390	–	Upright	8.0 (3/4" NPT)	Thread Relief	G1 (1, 2)	G1/S1 (1)
	TY4231	G7391	–	Pendent	8.0 (3/4" NPT)	Thread Relief	G1 (1)	N/A
	TY3331	G7378	–	HSW	5.6	Thread Relief	G4 (1)	N/A
	TY3431	G7375	–	VSW	5.6	Thread Relief	G4 (1)	N/A
TY-L	TY3111	G3111	S1800	Upright	5.6	Wrench Area	G1 (2) & G4 (1)	G4/S3 (1)
	TY3211	G3112	S1801	Pendent	5.6	Wrench Area	G1 (2) & G4 (1)	N/A
	TY3311	G3113	S1803	HSW	5.6	Wrench Area	–	N/A
	TY4811	–	S1805	Upright	8.0 (1/2" NPT)	Wrench Area	G4 (1, 2)	G4/S3 (1)
	TY4911	–	S1806	Pendent	8.0 (1/2" NPT)	Wrench Area	G4 (1)	N/A
	TY4111	G3101	S1810	Upright	8.0 (3/4" NPT)	Wrench Area	G4 (1, 2)	G4/S3 (1)
	TY4211	G3102	S1811	Pendent	8.0 (3/4" NPT)	Wrench Area	G4 (1)	N/A
TY-FRL	TY1121	G8973	S1879	Upright	2.8	Wrench Area	G4 (1)	N/A
	TY1221	G8971	S1880	Pendent	2.8	Wrench Area	G4 (1)	N/A
	TY3121	G8974	S1864	Upright	5.6	Wrench Area	G4 (1, 2)	G4/S3 (1)
	TY3221	G8972	S1865	Pendent	5.6	Wrench Area	G4 (1)	N/A
	TY3321	G8946	S1878	HSW	5.6	Wrench Area	G4 (1)	N/A
	TY4121	G8174	S1866	Upright	8.0 (3/4" NPT)	Wrench Area	G4 (1, 2)	G4/S3 (1)
	TY4221	G8172	S1867	Pendent	8.0 (3/4" NPT)	Wrench Area	G4 (1)	N/A

APPROVALS & NOTES:

1. Listed by Underwriters Laboratories Inc.
2. Approved by Factory Mutual Research Corporation.

N/A Not Applicable for noted sprinkler.

– No SIN, Listing or Approval

TABLE A — LABORATORY LISTINGS AND APPROVALS

seat against the Base to complete the installation as shown in Figures 1 and 2.

To help assist with the sliding of the Clips the Guard Installation Tool may be used as shown in Figure 3. In addition, pliers can be used to facilitate the final seating of the Clips.

NOTES

The Clips must seat against the Base in order to be considered fully seated and in order to complete the installation.

The G1,G4, G1/S1, and G4/S3 may be located in any position relative to the sprinkler frame arms.

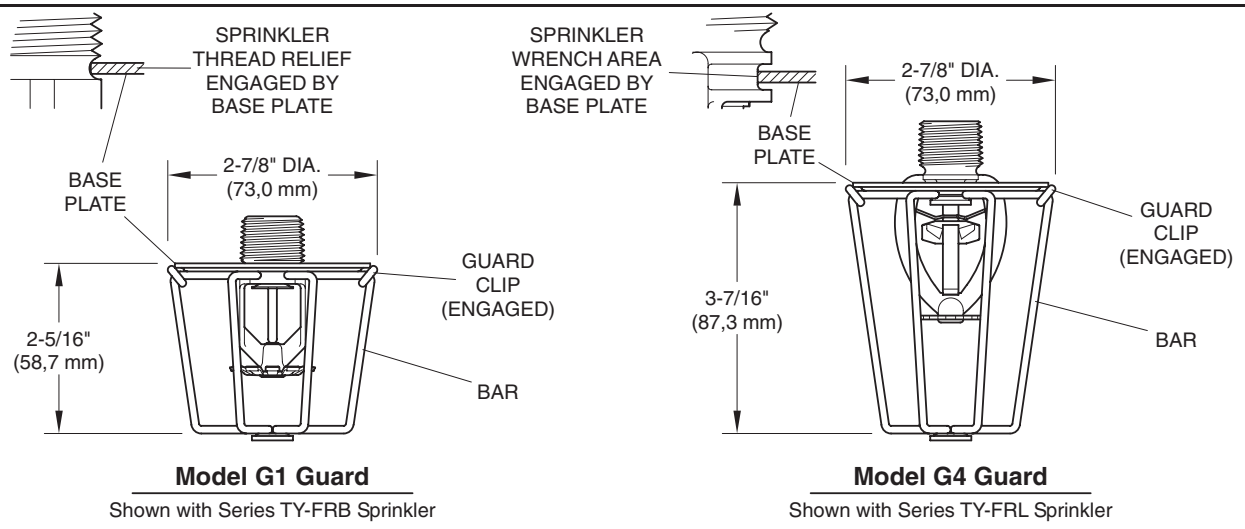


FIGURE 1
MODEL G1 AND G4 SPRINKLER GUARDS — DIMENSIONS

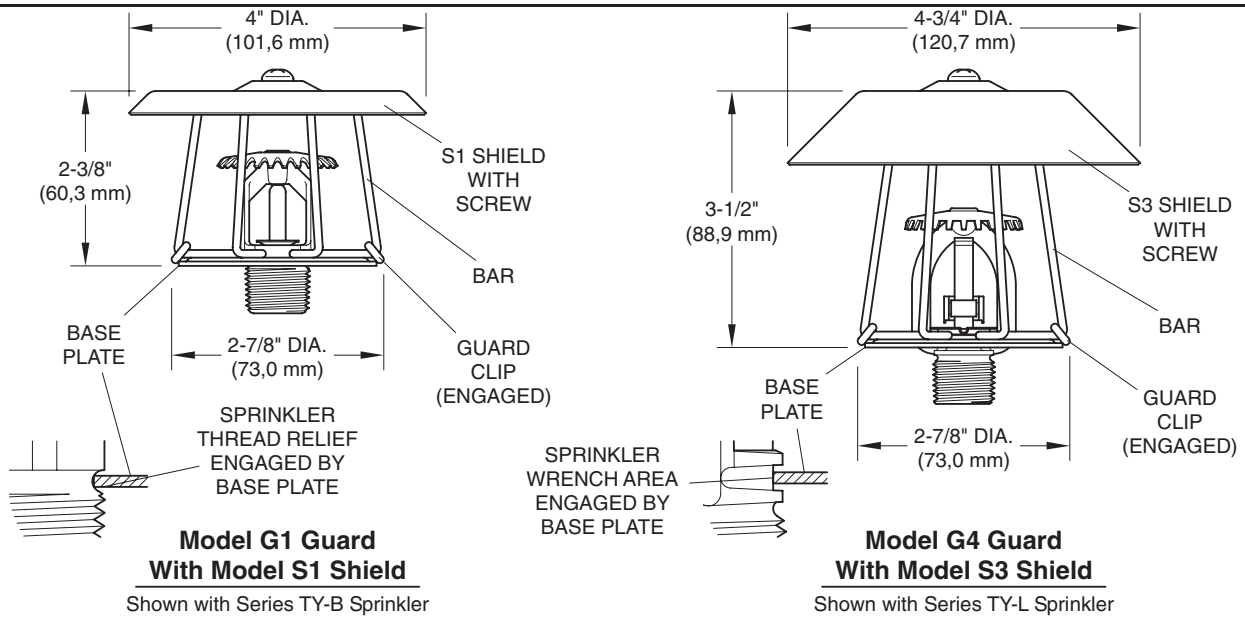


FIGURE 2
MODEL G1/S1 AND G4/S3 SPRINKLER GUARDS WITH SHIELDS — DIMENSIONS

Care and Maintenance

The Models G1, G4, G1/S1, and G4/S3 do not require any regularly scheduled maintenance; however, proper installation of the Sprinkler Guards should be verified during the annual visual inspection of the sprinklers.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any other authorities having jurisdiction. The installing contractor or sprinkler manufacturer should be contacted relative to any questions.

It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service.

Limited Warranty

Products manufactured by Tyco Fire Products are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by Tyco Fire Products. No warranty is given for products or

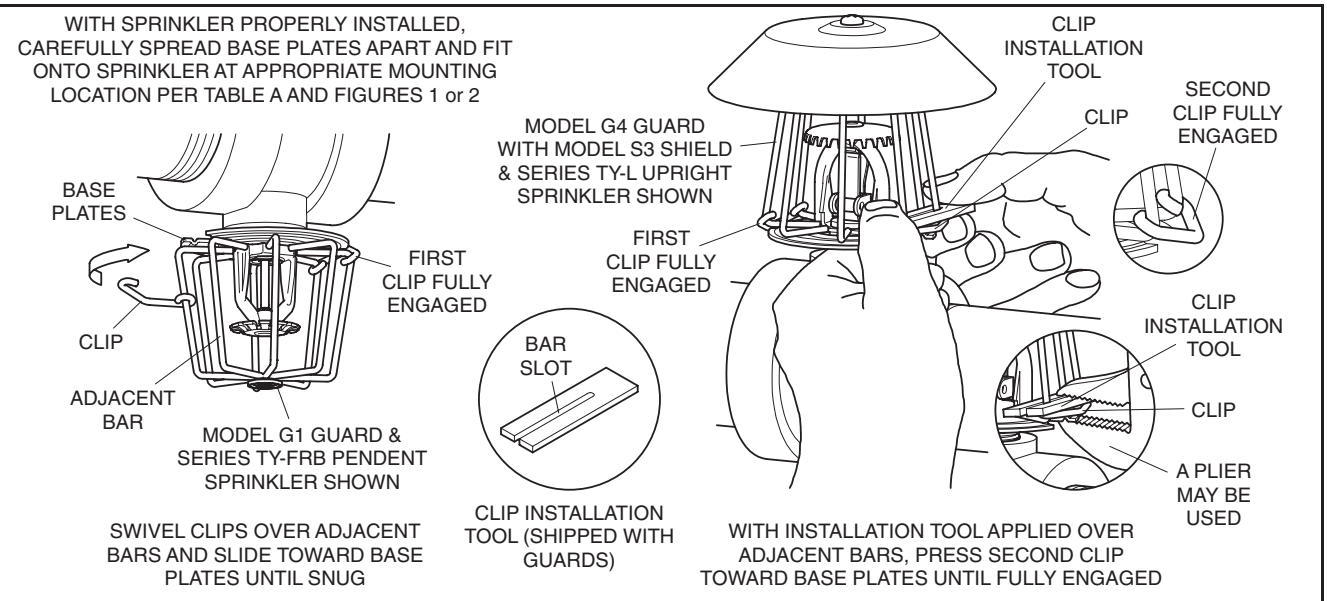


FIGURE 3
INSTALLATION PROCEDURE

components manufactured by companies not affiliated by ownership with Tyco Fire Products or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by Tyco Fire Products to be defective shall be either repaired or replaced, at Tyco Fire Products' sole option. Tyco Fire Products neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. Tyco Fire Products shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

IN NO EVENT SHALL TYCO FIRE PRODUCTS BE LIABLE, IN CONTRACT, TORT, STRICT LIABILITY OR UNDER ANY OTHER LEGAL THEORY, FOR INCIDENTAL, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LABOR CHARGES, REGARDLESS OF WHETHER TYCO FIRE PRODUCTS WAS INFORMED ABOUT THE POSSIBILITY OF SUCH DAMAGES, AND IN NO EVENT SHALL TYCO FIRE PRODUCTS' LIABILITY EXCEED AN AMOUNT EQUAL TO THE SALES PRICE.

THE FOREGOING WARRANTY IS MADE IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Ordering Procedure

Contact your local distributor for availability.

G1 Sprinkler Guard:
Specify: Model G1 Sprinkler Guard having a (specify) finish, P/N (specify).

Red Painted . . . . . P/N 56-938-1-001
Zinc Chromate . . . . . P/N 56-938-9-001

G4 Sprinkler Guard:
Specify: Model G4 Sprinkler Guard having a (specify) finish, P/N (specify).

Red Painted . . . . . P/N 56-937-1-001
Zinc Chromate . . . . . P/N 56-937-9-001

G1/S1 Guard with Shield:
Specify: Model G1/S1 Sprinkler Guard with Shield having a (specify) finish, P/N (specify).

Red Painted . . . . . P/N 56-938-1-066
Zinc Chromate . . . . . P/N 56-938-9-066

G4/S3 Guard with Shield:
Specify: Model G4/S3 Sprinkler Guard with Shield having a (specify) finish, P/N (specify).

Red Painted . . . . . P/N 56-937-1-066
Zinc Chromate . . . . . P/N 56-937-9-066

Additonal* Clip Installation Tool:
Specify: Clip Installation Tool for G1 & G4 Sprinkler Guards, P/N (56-000-8-597).

* The Clip Installation Tool is included with orders in original cartons.

SECTION III

HANGERS & BRACING

Fig. 65 and Fig. 66
Reversible C-Type Beam Clamps 3/4" and 1 1/4" Throat Openings

Component of State of California OSHPD Approved Seismic Restraints System

Size Range — (Fig. 65 and Fig. 66) 3/8", 1/2" and 5/8" rod

Material — Carbon Steel with hardened cup point set screw and jam nut

Function — Recommended for hanging from steel beam where flange thickness does not exceed 3/4" (Fig. 65) or 1 1/4" (Fig. 66).

Features — All steel construction eliminates structural deficiencies associated with casting type beam clamps. May be used on top or bottom flange of the beam. (Beveled lip allows hanging from top flange where clearance is limited.) May be installed with set screw in up or down position. Offset design permits unlimited rod adjustment by allowing the rod to be threaded completely through the clamp. Open design permits inspection of thread engagement.

Approvals — Underwriters' Laboratories Listed in the USA **(UL)** and Canada **(cUL)**. Factory Mutual Engineering approved. Conforms to Federal Specification WW-H-171E, Type 23 and Manufacturers Standardization Society SP-69, Type 19. Exceeds requirements of the National Fire Protection Association (NFPA), Pamphlet 13, 3/8" rod will support 1/2" thru 4" pipe, 1/2" rod will support 1/2" thru 8" pipe. Included in our Seismic Restraints Catalog approved by the State of California Office of Statewide Health Planning and Development (OSHPD). For additional load, spacing and placement relating to OSHPD projects, please refer to the TOLCO Seismic Restraint Systems Guidelines.

Finish — Plain

Note — Available in Electro-Galvanized and HDG finish.

Order By — Figure number, rod size and finish

Fig. 65 Patent #4,570,885

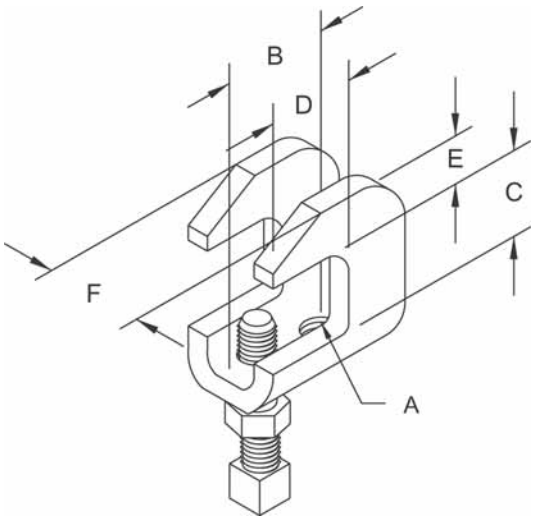


Fig. 65

Dimensions • Weights

Rod Size A	B	C	D	E	F	Max. Rec. Load Lbs.*	Approx. Wt./100
3/8	1 3/16	3/4	1	7/16	1	610	28
1/2	1 1/2	3/4	1	9/16	1 1/4	1130	55
5/8	1 1/2	3/4	1	9/16	1 1/4	1130	55

* Max. loads for clamp with set screw in up or down position.

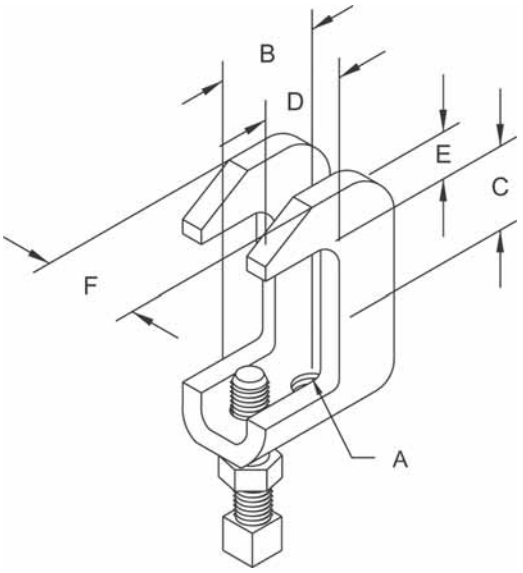


Fig. 66

Dimensions • Weights

Rod Size A	B	C	D	E	F	Max. Rec. Load Lbs.*	Approx. Wt./100
3/8	1 3/16	1 1/4	1	7/16	1	610	28
1/2	1 1/2	1 1/4	1	9/16	1 1/4	1130	55
5/8	1 1/2	1 1/4	1	9/16	1 1/4	1130	55

* Max. loads for clamp with set screw in up or down position.

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Fig. 69R - Retrofit Capable Beam Clamp Retaining Strap

Size Range — 3/8" and 1/2" rod; 4" thru 16" length.**

Material — Pre-Galvanized Steel

Function — To offer more secure fastening of various types of beam clamps to beam where danger of movement might be expected. NFPA 13 requires the use of retaining straps with all beam clamps installed in earthquake areas. Satisfies requirements of NFPA 13 (1999) 6-4.7.1.

Features — Beveled locking slot* is precisely formed to align with the threaded section of a hanger rod or set screw and engage the unit securely. May be used as shown in section "A-A" or inverted. Allows easy installation for new construction or retrofit applications.

Important Note — Good installation practice of a retaining strap requires that the strap be held tightly and securely to all component parts of the assembly. Therefore a locking mechanism of some kind, such as the beveled locking slot of the Fig. 69R or a hex nut tightened against other types of retaining straps will provide a more secure and reliable installation.

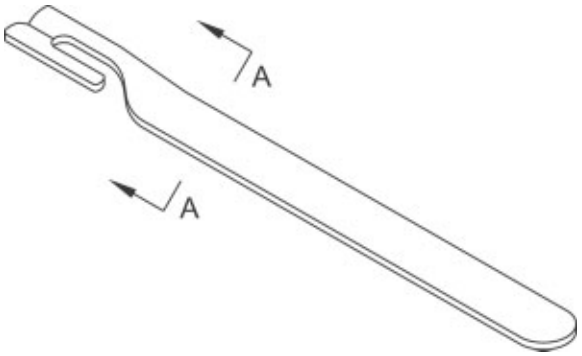
Approvals — Underwriters' Laboratories listed in the USA **(UL)** and Canada **(cUL)**. Approved for use with any listed beam clamp. Included in our Seismic Restraints Catalog approved by the State of California Office of Statewide Health Planning and Development **(OSHPD)**. For additional load, spacing and placement information relating to OSHPD projects, please refer to the TOLCO Seismic Restraint Systems Guidelines.

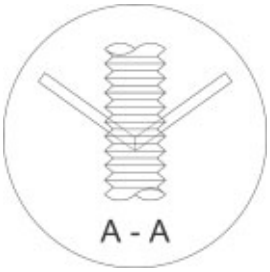
Finish — Pre-Galvanized

Order By — Figure number, rod or set screw size and length

Note — Minimum return on Strap: 1".

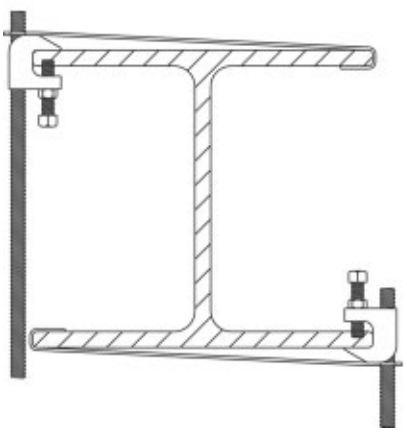
** Patent #5,947,424*





Dimensions • Weights

Rod Size A	Length
3/8"	Specify
1/2"	Specify



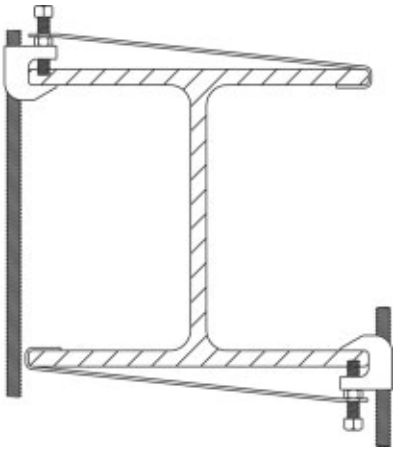


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Fig. 200 - "Trimline" Adjustable Band Hanger

Size Range — 1/2" thru 8" pipe

Material — Carbon Steel, Mil. Galvanized to G90 specifications

Function — For fire sprinkler and other general piping purposes. Knurled swivel nut design permits hanger adjustment after installation.

Features —

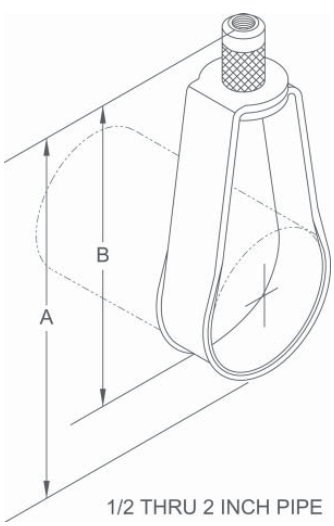
- (1/2" thru 2") Flared edges ease installation for all pipe types and protect CPVC plastic pipe from abrasion. Captured design keeps adjusting nut from separating with hanger. Hanger is easily installed around pipe.
- (2½" thru 8" Spring tension on nut holds it securely in hanger before installation. Adjusting nut is easily removed.

Approvals — Underwriters' Laboratories listed (1/2" thru 8") in the USA **(UL)** and Canada **(cUL)** for steel and CPVC plastic pipe and Factory Mutual Engineering Approved (3/4" thru 8"). Conforms to Federal Specifications WW-H-171E, Type 10 and Manufacturers Standardization Society SP-69, Type 10.

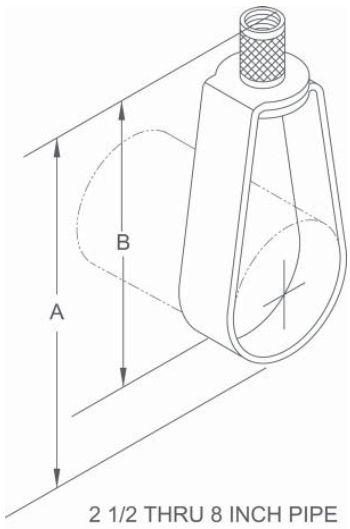
Maximum Temperature — 650°F

Finish — Mil. Galvanized. For Stainless Steel materials, order TOLCO™ Fig. 200WON.

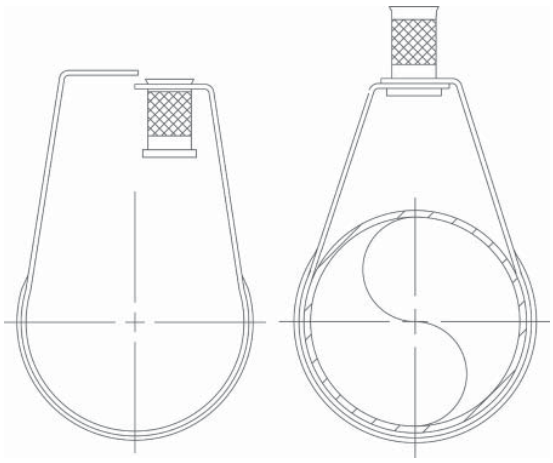
Order By — Figure number and pipe size



1/2 THRU 2 INCH PIPE



2 1/2 THRU 8 INCH PIPE



Dimensions • Weights

Pipe Size	Rod Size Inch	Rod Size Metric	A	B	Max. Rec. Load Lbs.	Approx. Length
1/2	3/8	8mm or 10mm	3⅛	2⅝	400	11
3/4	3/8	8mm or 10mm	3⅛	2½	400	11
1	3/8	8mm or 10mm	3⅜	2⅝	400	12
1¼	3/8	8mm or 10mm	3¾	2⅞	400	13
1½	3/8	8mm or 10mm	3⅞	2⅞	400	14
2	3/8	8mm or 10mm	4½	3	400	15
2½	3/8	10mm	5⅝	4⅛	600	27
3	3/8	10mm	5⅞	4	600	29
3½	3/8	10mm	7⅜	5¼	600	34
4	3/8	10mm	7⅜	5	1000	35
5	1/2	12mm	9⅛	6¼	1250	66
6	1/2	12mm	10⅛	6¾	1250	73
8	1/2	12mm	13⅛	8¾	1250	136

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Fig. 25 - Surge Restrainer

c UL US LISTED

Size Range — One size fits 3/4" thru 2" pipe.

Material — Steel

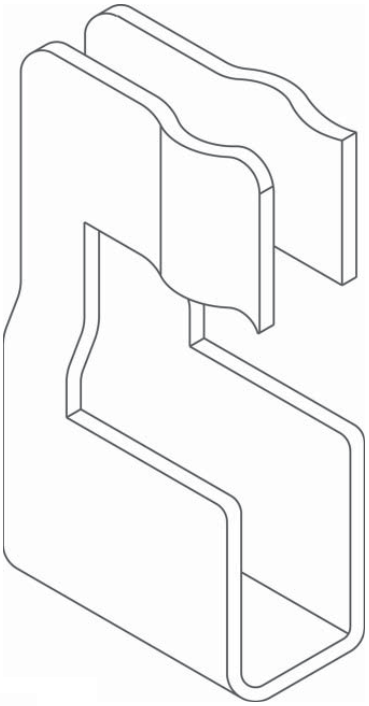
Function — Designed to be used in conjunction with TOLCO™ Band Hangers to restrict the upward movement of piping as it occurs during sprinkler head activation or earthquake type activity. The surge restrainer is easily and efficiently installed by snapping into a locking position on the bank hanger. This product is intended to satisfy the requirements as indicated in the National Fire Protection Association (NFPA 13, 1999 Edition), 6-2.3.3, 6-2.3.4 and A-6i-2.3.3 Can be used to restrain either steel pipe or CPVC plastic Pipe.

Approvals — Underwriters' Laboratories Listed **only** when used with TOLCO band hangers Fig. 2, 2NFPA and 200, in the USA **(UL)** and Canada **(cUL)**.

Finish — Pre-Galvanized

Order By — Figure number and TOLCO band hanger, size from 3/4" thru 2".

Patent #5,344,108



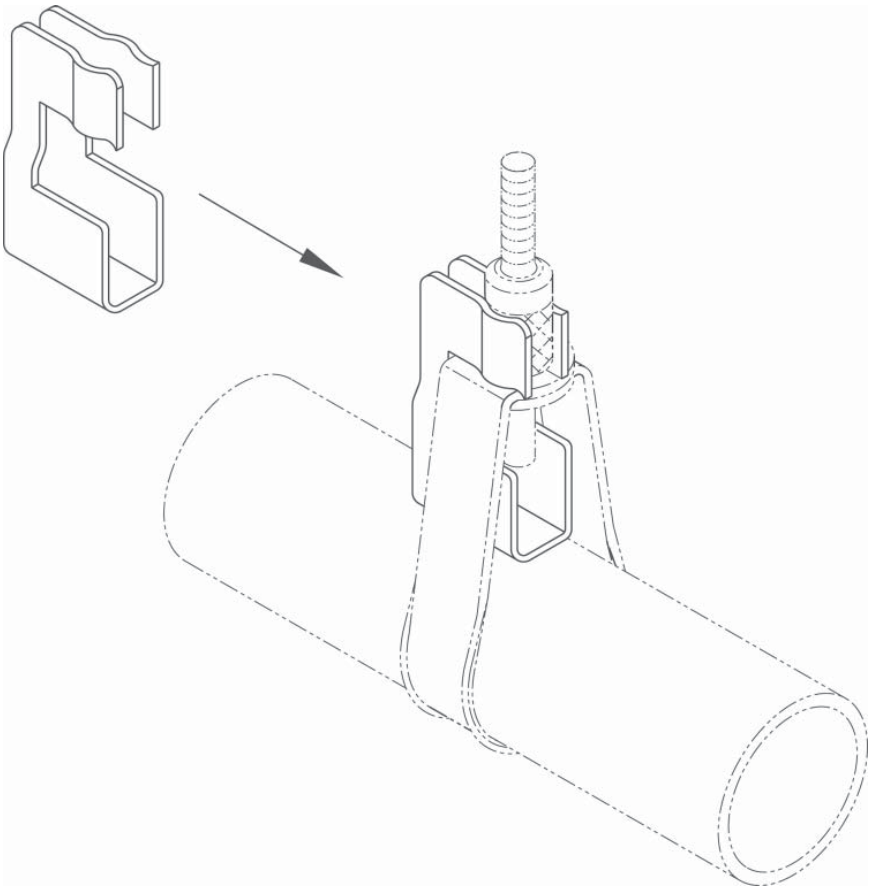


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Fig. 75 - Swivel

Size Range — 3/8" Rod Attachment

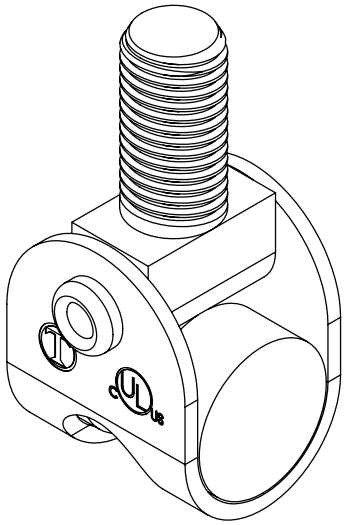
Material — Carbon Steel

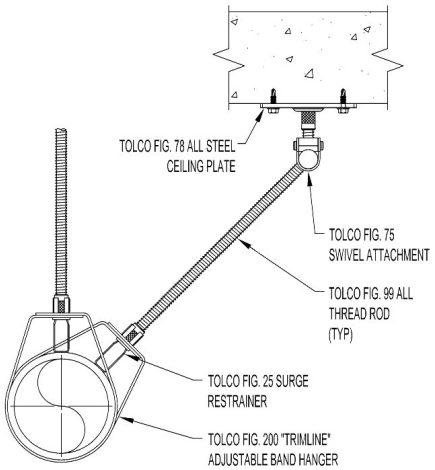
Function — There are three recommended applications for this product: May be used as End of Branch Restraint for structural attachment to anchor bolt, beam clamp, etc. May be used with a pitched or sloped roof application, to meet requirements of NFPA 13 (2002) Sec 9.1.2.5. May be used as an upper attachment with short hanger rod to omit seismic bracing (per UBC97).

Approvals — Underwriters' Laboratories Listed in the USA **(UL)** and Canada **(cUL)**. Meets requirements of Uniform Building Code (UBC) 1997 Table O, Section 3.B.

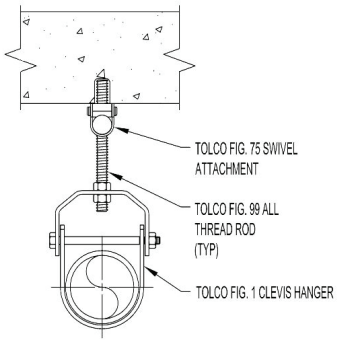
Finish — Electro-Galvanized

Order By — Figure number

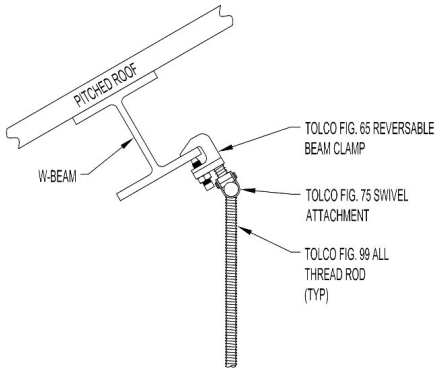




May be used as a structural attachment component of an end of branch restraint.



May be used as an upper attachment with short hanger rod to omit seismic bracing (per UBC97).



May be used with a pitched roof application, to meet requirements of NFPA 13 (2002) Sec 9.1.2.5.

Fig. 98 - Rod Stiffener

Component of State of California OSHPD Approved Seismic Restraints System

Size Range — Secures 3/8" thru 7/8" hanger rod

Material — Carbon Steel

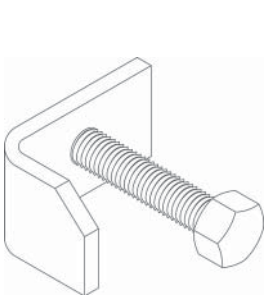
Function — Secures channel to hanger rod for vertical seismic bracing.

Approvals — Underwriters Laboratories Listed in the USA (**UL**) and Canada (**cUL**). Included in our Seismic Restraints Catalog approved by the State of California Office of Statewide Health Planning and Development (**OSHPD**). For additional load, spacing and placement information relating to OSHPD projects, please refer to the TOLCO Seismic Restraint Systems Guidelines

Finish — Electro Galvanized

Note — Available in HDG finish or Stainless Steel materials.

Order By — Figure number



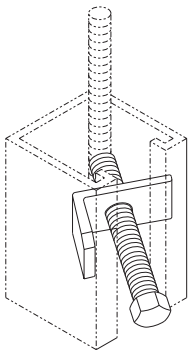


Fig. 99 - All Thread Rod Cut to Length

Size Range — Secures 3/8" thru 7/8" rod in 1" increments

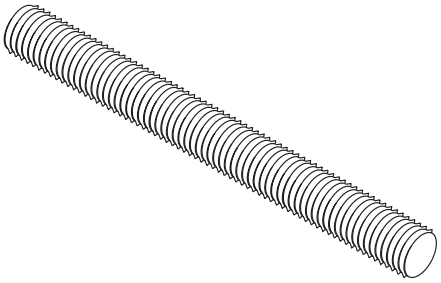
Material — Carbon Steel

Maximum Temperature — 750°F

Finish — Plain

Note — Available in Electro-Galvanized and HDG finish or Stainless Steel materials.

Order By — Figure number, rod diameter, rod length and finish



Dimensions • Weights

Rod Size	Max. Rec. Load Lbs. For Service Temps 650°F	750°F
3/8	610	540
1/2	1130	1010
5/8	1810	1610
3/4	2710	2420
7/8	3770	3360

Fig. 100 - All Thread Rod Full Lengths

Size Range — Secures 3/8" thru 7/8" rod in 10' lengths

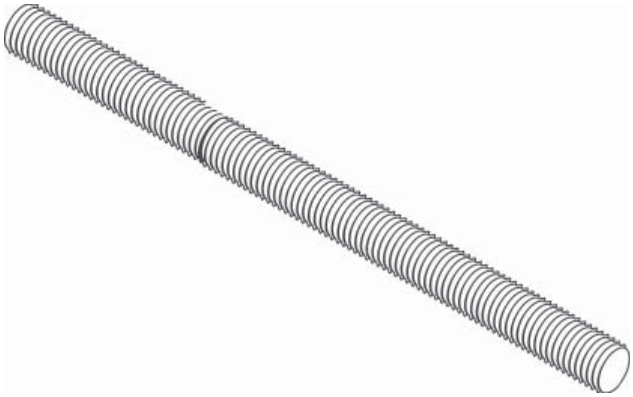
Material — Carbon Steel

Maximum Temperature — 750°F

Finish — Plain

Note — Available in Electro-Galvanized and HDG finish or Stainless Steel materials.

Order By — Figure number, rod diameter and finish



Dimensions • Weights

Rod Size	Max Rec. Load Lbs. For Service Temps 650°F	750°F	Approx. Wt./100
1/4	240	215	12
3/8	610	540	29
1/2	1130	1010	53
5/8	1810	1610	84
3/4	2710	2420	123
7/8	3770	3360	169
1	4960	4420	222
1¼	8000	7140	360
1½	11630	10370	510

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Fig. 70 - Steel Rod Coupling
Fig. 70R - Steel Reducing Rod Coupling
Fig. 70S - Short Pattern Steel Rod Coupling
Fig. 71 - Steel Window Rod Coupling

Size Range — 1/4" thru 1 1/2" rod

Material — Carbon Steel

Function — Used for coupling two threaded rods together of equal or reduced rod sizes, with or without inspection hole.

Finish — Electro-Galvanized

Note — Available in HDG finish or Stainless Steel materials.

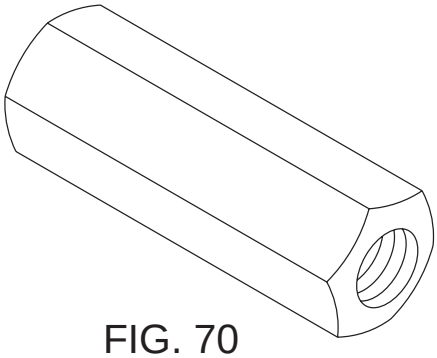

FIG. 70

Fig. 70

Dimensions • Weights

Rod Size	Length	Max Rec. Load Lbs.	Approx. Wt./100
1/4	7/8	240	2
5/16	1 3/4	300	13
3/8	1 3/4	610	11
1/2	1 3/4	1130	11
5/8	2 1/8	1810	16
3/4	2 1/4	2710	27
7/8	2 1/2	3770	57
1	2 3/4	4960	70

1 1/8" - 1 1/2" — Consult factory for specifications

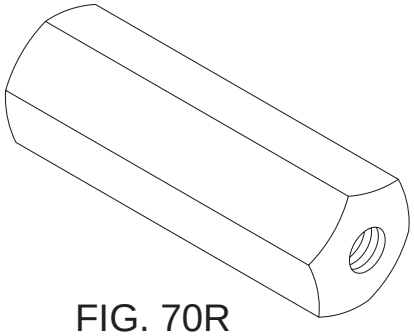

FIG. 70R

Fig. 70R

Dimensions • Weights

Rod Size	Length	Max Rec. Load Lbs.	Approx. Wt./100
3/8 x 1/4	1	240	4
1/2 x 3/8	1 1/4	610	7
5/8 x 1/2	1 1/4	1130	14
3/4 x 5/8	1 1/2	1810	21
7/8 x 3/4	1 3/4	2710	40

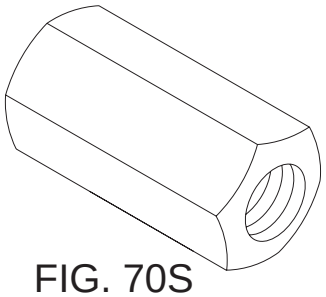

FIG. 70S

Fig. 70S/Fig. 71

Dimensions • Weights

Rod Size	Length	Max Rec. Load Lbs.	Approx. Wt./100
3/8	1 1/8	610	4
1/2	1 1/4	1130	6

For rod sizes 5/8" to 1" - consult factory

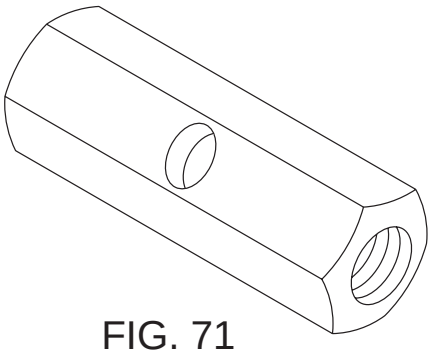

FIG. 71

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Fig. 113 - Standard Hex Nut

Size Range — Size1/4" thru 1 1/2"
Material — Carbon Steel
Finish — Plain
Note — Available in Electro-Galvanized and HDG finish or Stainless Steel materials.
Order By — Figure number size and finish

Dimensions • Weights

Rod Size	Width Across Flats	Width Across Points	Thickness	Approx. Wt./100
1/4	7/16	1/2	7/32	.7
5/16	1/2	37/64	17/64	1.1
3/8	9/16	21/32	21/64	1.6
1/2	3/4	55/64	7/16	3.7
5/8	15/16	1 3/32	35/64	7.3
3/4	1 1/8	1 5/16	41/64	12.0
7/8	1 5/16	1 33/64	3/4	19.0
1	1 1/2	1 3/4	55/64	28.0
1 1/4	1 7/8	2 11/64	1 1/16	54.0
1 1/2	2 1/4	2 19/32	1 9/32	94.0

Fig. 114 - Heavy Hex Nut

Size Range — Size1/4" thru 1 1/2"
Material — Carbon Steel
Finish — Plain
Note — Available in Electro-Galvanized and HDG finish or Stainless Steel materials.

Dimensions • Weights

Rod Size	Width Across Flats	Width Across Points	Thickness	Approx. Wt./100
1/4	1/2	37/64	15/64	1.2
5/16	9/16	21/32	19/64	1.7
3/8	11/16	51/64	23/64	3.1
1/2	7/8	1 1/6	31/64	6.5
5/8	1 1/16	1 15/64	39/64	12.0
3/4	1 1/4	1 29/64	47/64	19.0
7/8	1 7/16	1 21/32	55/64	30.0
1	1 5/8	1 7/8	63/64	43.0
1 1/4	2	2 5/16	1 7/32	79.0
1 1/2	2 3/8	2 3/4	1 15/32	131.0

Fig. 115 - Flat Washer

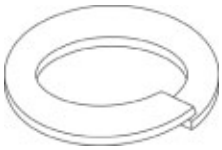
Size Range — Size1/4" thru 1 1/2"
Material — Carbon Steel
Finish — Plain
Note — Available in Electro-Galvanized and HDG finish or Stainless Steel materials.
Order By — Figure number size and finish

Dimensions • Weights

Rod Size	Outside Diameter	Approx. Wt./100
1/4	3/4	.7
5/16	1	1.5
3/8	1 3/8	3.9
1/2	1 3/4	7.7
5/8	1 5/16	7.3
3/4	2	11.0
7/8	2 1/4	19.0
1	2 3/4	22.0
1 1/4	3	26.0
1 1/2	3 1/2	39.0

Fig. 117 - Lock Washer

Size Range — Size1/4" thru 3/4" bolt
Material — Carbon Steel
Finish — Plain
Note — Available in Electro-Galvanized and HDG finish or Stainless Steel materials.
Order By — Figure number size and finish



Dimensions • Weights

Rod Size	Outside Diameter	Approx. Wt./100
3/8	11/16	.6
1/2	7/8	1.3
5/8	1 1/16	2.4
3/4	1 1/4	4.0

Fig. 4 - Standard Pipe Clamp
Fig. 4F - Standard Pipe Clamp Felt Lined
Fig. 4PVC - Standard Pipe Clamp PVC Coated

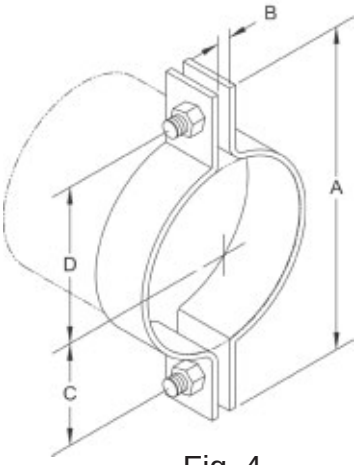


Fig. 4

Size Range — (Fig. 4) Size 1/2" thru 30" pipe.

Size Range — (Fig. 4F) Size 1/2" thru 2 1/2" copper tubing

Material — Carbon Steel

Function — Recommended for the suspension of non-insulated pipe or insulated pipe with Fig. 220 shields. (Use Fig. 330 Weldless Eye Nut, Fig. 102 Eye Rod or Fig. 101 Welded Eye Rod.) Also recommended for attachment of sway bracing up to 3 1/2" pipe size, for larger pipe sizes use Fig. 4A. Fig. 4F and Fig. 4PVC are designed to reduce noise and vibration and/or prevent electrolysis.

Approvals — Underwriters' Laboratories Listed in the USA **(UL)**, Canada **(cUL) 3/4" - 8"**, and approved by Factory Mutual Engineering, 3/4" - 8". Federal Specification WW-H-171E, Type 4, 11/2" thru 24" and Manufacturers Standardization Society SP-69, Type 4. Included in our Seismic Restraints Catalog approved by the State of California Office of Statewide Health Planning and Development **(OSHPD)**.

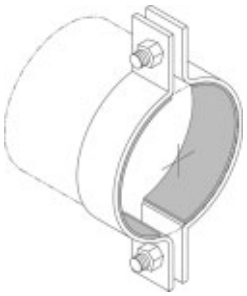


Fig. 4F

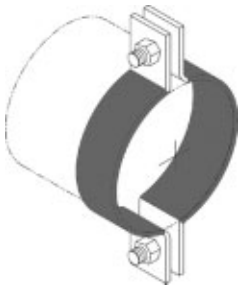


Fig. 4PVC

Note — When the Fig. 4 is used as a sway brace, to ensure performance, the **UL Listing requires that it must be used with other TOLCO™ brace products**.

Maximum Temperature — 750°F

Finish — Plain

Note — Available in Electro-Galvanized and HDG finish or Stainless Steel materials.

Order By — Figure number, pipe size and finish.

Order Note — When ordering Fig. 4F allow for 3/16" felt on each half of clamp.

Dimensions • Weights

Pipe Size	A	B	C	D	Bolt Size	Max. Design Load Lbs. For Service Temp. 650°	750°F	Approx. Wt./100
1/2	3 7/16	1/4	1 1/8	1 1/8	5/16	500	445	29
3/4	3 9/16	1/4	1 1/4	1 1/4	5/16	500	445	31
1	3 9/16	1/4	1 1/4	1 5/16	5/16	500	445	35
1 1/4	4 3/16	1/2	1 3/8	1 11/16	5/16	500	445	40
1 1/2	4 9/16	5/16	1 5/8	1 7/8	5/16	800	715	42
2*	5 9/16	1/2	2	2 1/4	39	1040	930	93
2 1/2*	6 7/16	9/16	2 1/2	2 3/4	1/2	1040	930	126
3*	7	5/8	2 3/4	3 1/16	1/2	1040	930	141
3 1/2	7 11/16	3/8	3 1/8	3 3/8	1/2	1040	930	154
4	8 1/2	5/8	3 5/16	3 11/16	5/8	1040	930	229
5	9 3/4	3/4	3 7/8	4 3/8	5/8	1040	930	261
6	11 5/8	3/4	4 7/8	5 1/8	3/4	1615	1440	537
8	13 5/16	1	5 5/8	6	3/4	1615	1440	625
10	16 1/2	1	7 1/4	7 1/4	7/8	2490	2220	1378
12	18 1/2	1	8 1/4	8 1/4	7/8	2490	2220	1574
14	20	1 1/8	9	9	7/8	2490	2220	2103
16	23	1 1/8	10 1/4	10 1/4	7/8	2490	2220	2314
18	25 7/8	1 1/4	11 1/2	11 1/2	1	3060	2730	3276
20	28	1 3/8	12 1/2	12 1/2	1 1/8	3060	2730	3863
24	33 1/2	1 5/8	15 1/4	15 1/4	1 1/4	3060	2730	5222
30	41 7/8	2	19	19	1 3/4	3500	3360	10511

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Fig. 4A - Pipe Clamp for Sway Bracing

Component of State of California OSHPD Approved Seismic Restraints System

c UL US LISTED

Size Range — 4" thru 8" pipe. For sizes smaller than 4" use TOLCO™ Fig. 4.

Material — Carbon Steel

Function — For bracing pipe against sway and seismic disturbance.

Approvals — Underwriters' Laboratories Listed in the USA **(UL)** and Canada **(cUL)** 4" thru 8". Included in our Seismic Restraints Catalog approved by the State of California Office of Statewide Health Planning and Development (OSHPD).

Installation Instructions — The Fig. 4A is the "braced pipe" attachment component of a longitudinal, lateral or riser brace assembly. It is intended to be combined with the "bracing pipe" and TOLCO transitional and structural attachment component(s) to form a complete bracing assembly. NFPA 13 and/or OSHPD guidelines should be followed.

To Install — Place the Fig. 4A over the pipe to be braced. Attach TOLCO transitional fitting, either Fig. 980, 910 or 909, to the clamp ears. Tighten bolts and nuts; torque requirement is a minimum of 50 ft. lbs. Transitional fitting attachment can pivot for adjustment to proper brace angle.

Finish — Plain

Note — Available in Electro-Galvanized and HDG finish or Stainless Steel materials.

Order By — Figure number, pipe size and finish

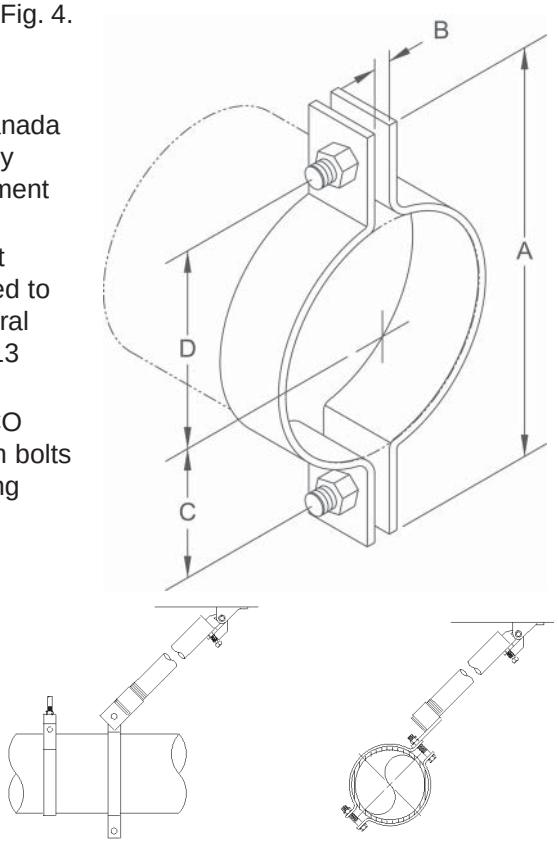


Fig. 4A - Longitudinal Brace

TOLCO® brand bracing components are desgined to be compatible **ONLY** with other TOLCO® brand bracing components, resulting in a Listed seismic bracing assembly. DISCLAIMER — NIBCO does **NOT** warrant against the failure of TOLCO® brand bracing components, in the instance that such TOLCO® brand bracing components are used in combination with products, parts or systems which are not manufactured or sold under the TOLCO® brand. NIBCO shall **NOT** be liable under any circumstance for any direct or indirect, incidental or consequential damages of any kind, including but not limited to loss of business or profit, where non-TOLCO brand bracing components have been, or are used.

Dimensions • Weights

Pipe Sizes	A	B	C	D	Bolt Size	Max. Horizontal Design Load	Approx. Wt./100
4	8½	9/16	3⅜	3 11/16	1/2	2015	221
5	9¾	9/16	3⅞	4⅜	1/2	2015	253
6	11½	5/8	5	5⅛	1/2	2015	513
8	13¼	3/4	6 11/16	6⅛	1/2	2015	601

Fig. 6 - Riser Clamp
Fig. 6F - Felt Lined Riser Clamp
Fig. 6PVC - PVC Coated Riser Clamp

Size Range — (Fig. 6) 1/2" thru 20" pipe
(Fig. 6F) 1/2" thru 2½" copper tubing
(Fig. 6PVC) 1/2" thru 6" pipe

Material — Carbon Steel

Insulation Material — (Fig. 6F) 3/16" felt.

Function — Used for supporting vertical piping.

Approvals — Underwriters' Laboratories Listed in the USA **(UL)**, Canada **(cUL) 1/2" - 8"**. Factory Mutual Engineering Approved, **3/4" thru 8"**. Conforms to Federal Specification WW-H-171E, Type 8, **3/4" thru 20"** and Manufacturers Standardization Society SP-69, Type 8.

Maximum Temperature — 650°F

Finish — Plain

Note — Available in Electro-Galvanized and HDG finish or Stainless Steel materials.

Order By — (Fig. 6 and Fig. 6PVC) pipe size and finish. (Fig. 6F) copper tube size and finish. (Fig. 6F is available for Iron Pipe Size, consult factory.

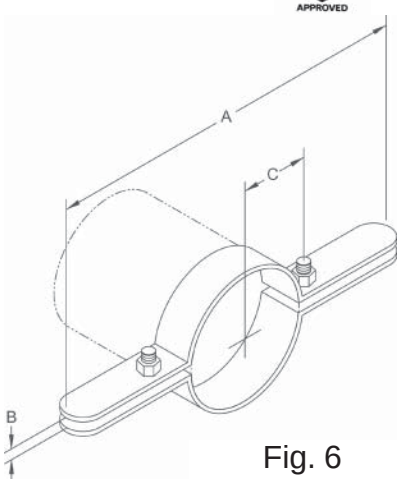


Fig. 6

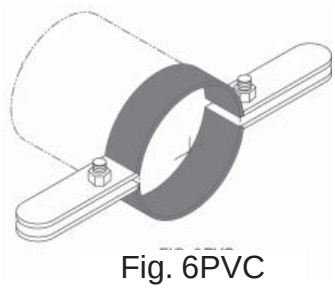


Fig. 6PVC

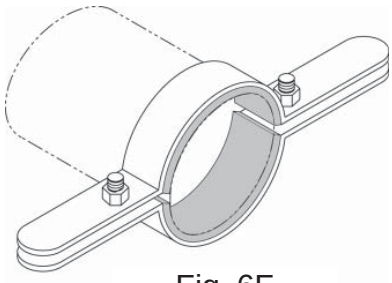


Fig. 6F

Dimensions • Weights

Pipe Size	A	B	C	Bolt Size	Max. Rec. Load Lbs.	Approx. Wt./100
1/2	9¼	1/2	1⅛	3/8	255	144
3/4	9¼	1/2	1⅛	3/8	255	144
1	9⁹⁄₁₆	1/2	1¼	3/8	255	147
1¼	9¹¹⁄₁₆	1/2	1⅜	3/8	255	150
1½	10⅜	1/2	1½	3/8	255	153
2	10¾	1/2	2	3/8	255	165
2½	11	5/8	2¼	3/8	390	228
3	12	5/8	3	3/8	530	246
3½	13	5/8	3¼	1/2	670	264
4	13½	3/4	3⅜	1/2	810	347
5	14½	3/4	4⅜	1/2	1160	385
6	15⅛	7/8	4⅞	1/2	1570	564
8	18½	1	5¾	5/8	2500	1017
10	20¼	1	7¼	5/8	2500	1138
12	22¾	1	8¼	5/8	2700	1759
14	24	1⅛	9	5/8	2700	1922
16	26	1⅛	10¼	3/4	2900	3245
18	28	1¼	11½	3/4	2900	3372
20	30	1⅜	12½	3/4	2900	3499

TOLCO
a brand of NIBCO

Fig. 1001 Sway Brace Attachment

APPLICATIONS

- The pipe attachment component of a lateral sway brace assembly
- Can also be used as a component of a 4-way, top of riser, sway brace assembly

FEATURES

- Unique design allows for fast and easier installation
- 2015 lb. Maximum Horizontal Design Load with 1" brace pipe
- 2765 lb. Maximum Horizontal Design Load with 1 1/4" brace pipe
- Can be used to brace schedule 7 through 40 pipe
- Cannot be over tightened which could damage thin-wall pipe
- Visual verification of proper installation torque

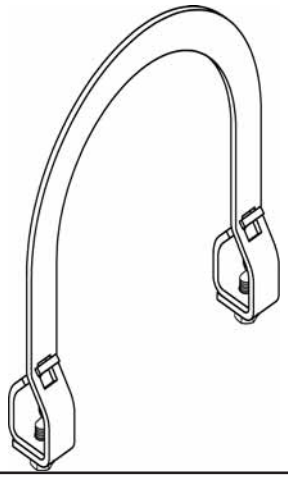
APPROVALS

- Underwriter's Laboratories Listed in USA (UL) and Canada (cUL)
- Approved by State of California, Office of Statewide Health Planning and Development (OSHPD)

FIG. 1001

Fig. 1001 - Sway Brace Attachment

Component of State of California OSHPD Approved Seismic Restraints System



Size Range — Pipe size to be braced: 2½" thru 8" IPS.* Pipe size used for bracing: 1" and 1¼" Schedule 40 IPS.

Material — Carbon Steel

Function — For bracing pipe against sway and seismic disturbance. The pipe attachment component of a sway brace system: The Fig. 1001 is used in conjunction with a TOLCO™ 900 Series fitting and joined together with bracing pipe per NFPA 13, forming a complete sway brace assembly.

Features — *Can be used to brace schedules 7 through 40 IPS. Field adjustable, making critical pre-engineering of bracing pipe length unnecessary. Unique design requires no threading of bracing pipe. Can be used as a component of a four-way riser brace. Comes assembled and ready for installation. Fig. 1001 has built-in visual verification of correct installation. See installation note below.

Installation Note — Position Fig. 1001 over the pipe to be braced and tighten two hex head cone point set bolts until heads bottom out. A minimum of 1" pipe extension is recommended.

Approvals — Underwriters Laboratories Listed in the USA **(UL)** and Canada **(cUL)**. Included in our Seismic Restraints Catalog approved by the State of California Office of Statewide Health Planning and Development **(OSHPD)**. For additional load, spacing and placement information relating to OSHPD projects, please refer to the TOLCO Seismic Restraint Systems Guidelines.

Finish — Plain

Note — Available in Electro-Galvanized and HDG finish.

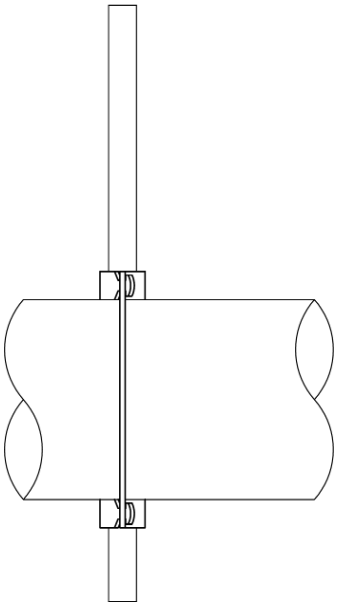
Order By — Indicate pipe size to be braced followed by pipe size used for bracing, figure number and finish.

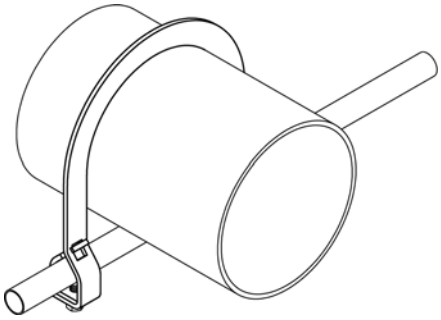
Important Note — The Fig. 1001 is precision manufactured to perform its function as a critical component of a complete bracing assembly.

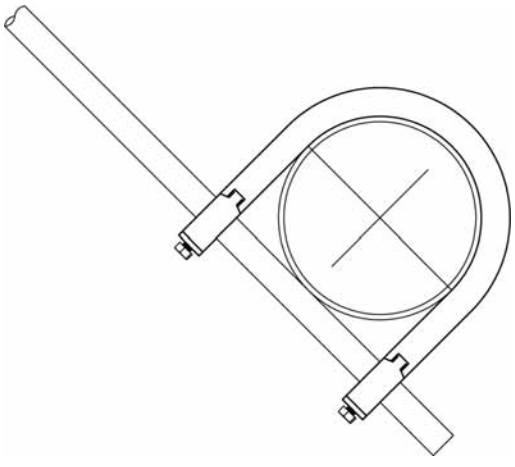
To ensure performance, the UL Listing requires that the Fig. 1001 must be used only with other TOLCO bracing products. The Fig 1001 is not intended for use with the Fig. 907 4-Way Longitudinal Brace Attachment.

NATIONAL AND INTERNATIONAL PATENT APPLICATION IN PROCESS

Maximum Design Load
Sch 7 - 1600 lbs.
Sch 10 & 40 w/1" Brace Pipe - 2015 lbs.
Sch 10 & 40 w/1¼" Brace Pipe - 2765 lbs.







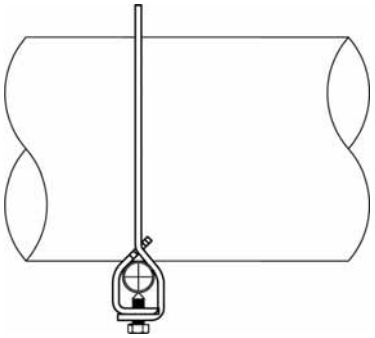


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Fig. 800 - Adjustable Sway Brace Attachment to Steel

c UL us LISTED

Component of State of California OSHPD Approved Seismic Restraints System

Size Range — 4" thru 18" beam width

Material — Carbon Steel

Function — Seismic brace attachment to steel.

Features — This product's design incorporates a concentric attachment point which is critical to the performance of structural seismic connections. NFPA 13 indicates the importance of **concentric** loading of connections and fasteners. Permits secure connection to steel where drilling and/or welding of brace connection could present structural issues.

Installation Instructions — The Fig. 800 is the structural attachment component of a longitudinal or lateral sway brace assembly. It is intended to be combined with the a TOLCO transitional attachment, "bracing pipe" and a TOLCO "braced pipe" attachment to form a complete bracing assembly. NFPA 13 and/or OSHPD guidelines should be followed.

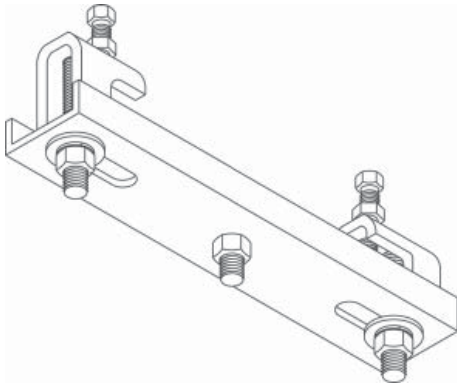
To Install — Place the Fig. 800 on the steel beam, tighten the cone point set bolts on flange until bolt heads break off. Tighten hex head bolts into clamp body until lock washers are fully flat. Attach other TOLCO transitional attachment fittings, Fig. 909, 910 or 980. Transitional fitting attachment can pivot for adjustment to proper brace angle.

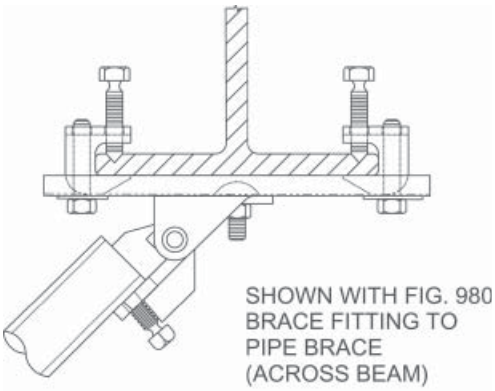
Approvals — Underwriters Laboratories Listed in the USA **(UL)** and Canada **(cUL)**. Included in our Seismic Restraints Catalog approved by the State of California Office of Statewide Health Planning and Development (**OSHPD**). For additional load, spacing and placement information relating to OSHPD projects, please refer to the TOLCO Seismic Restraint Systems Guidelines.

Finish — Plain

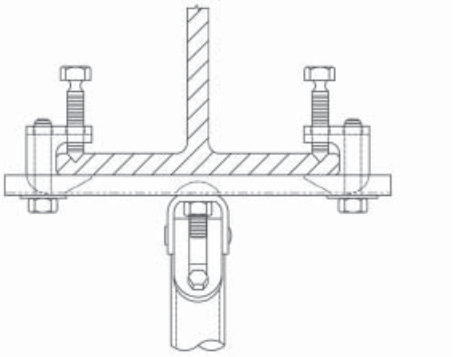
Note — Available in Electro-Galvanized and HDG finish.

Order By — Figure number, type number and size number.





SHOWN WITH FIG. 980 BRACE FITTING TO PIPE BRACE (ACROSS BEAM)



SHOWN WITH FIG. 980 BRACE FITTING TO PIPE BRACE (ALONG BEAM)

Dimensions • Weights

Size	Fits Beam Range (In.)	*Max. Design Loads/Lbs. Along Beam	Across Beam
1	4 - 6	1265	2015
2	6 - 8	1265	2015
3	8 - 10	1265	2015
4	10 - 12	1265	2015
5	12 - 14	1265	2015
6	14 - 16	1265	2015
7	16 - 18	1265	2015

Dimensions • Weights

Type	Flange Thickness Max. (In.)	*Max. Design Loads/Lbs. Along Beam	Across Beam
1	3/4	1265	2015
2	1¼	1265	2015

TOLCO® brand bracing components are desgined to be compatible **ONLY** with other TOLCO® brand bracing components, resulting in a Listed seismic bracing assembly. **DISCLAIMER** — NIBCO does **NOT** warrant against the failure of TOLCO® brand bracing components, in the instance that such TOLCO® brand bracing components are used in combination with products, parts or systems which are not manufactured or sold under the TOLCO® brand. NIBCO shall **NOT** be liable under any circumstance for any direct or indirect, incidental or consequential damages of any kind, including but not limited to loss of business or profit, where non-TOLCO brand bracing components have been, or are used.

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Fig. 909 - No-Thread Swivel Sway Brace Attachment

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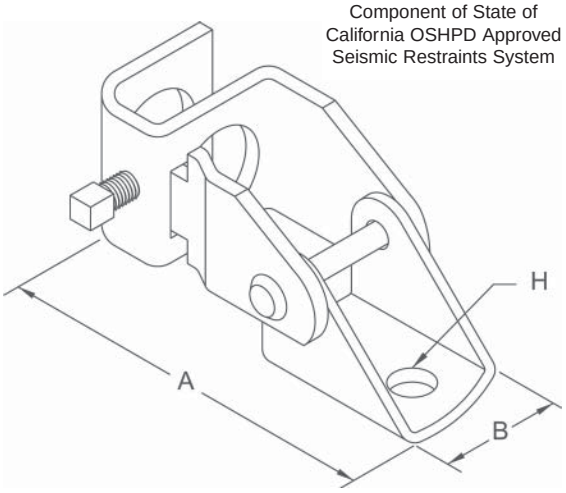
Component of State of California OSHPD Approved Seismic Restraints System



Size Range — 1" bracing pipe. For brace pipe sizes larger than 1", use TOLCO Fig. 980.

Material — Carbon Steel, hardened cone point engaging screw

Function — The structural component of a sway and seismic bracing system.

Features — This product's design incorporates a **concentric** attachment opening which is critical to the performance of structural seismic connections. NFPA 13 (2002) Figure 9.3.5.9.1 indicates clearly that fastener table load values are based only on concentric loading. No threading of the bracing pipe is required. Open design allows for easy inspection of pipe engagement.

Application Note — The Fig. 909 is used in conjunction with the TOLCO Fig. 1000, Fig. 1001, or Fig. 4 (A) pipe clamp, and joined together with bracing pipe. Sway brace assemblies are intended to be installed in accordance with NFPA 13 (or TOLCO State of California OSHPD Approved Seismic Restraint Manual) and the manufacturer's installation instructions. The required type, number and size of fasteners used for the structure attachment fitting shall be in accordance with NFPA 13 and/or OSHPD.

Approvals — Underwriters Laboratories Listed in the USA **(UL)** and Canada **(cUL)**. Included in our Seismic Restraints Catalog approved by the State of California Office of Statewide Health Planning and Development **(OSHPD)**. For additional load, spacing and placement information relating to OSHPD projects, please refer to the TOLCO Seismic Restraint Systems Guidelines.

Installation Instructions — The Fig. 909 is the structural or transitional attachment component of a longitudinal or lateral sway brace assembly. It is intended to be combined with the "bracing pipe" and TOLCO "braced pipe" attachment, Fig. 1000, 1001, 4A, 4B or 4L to form a complete bracing assembly. NFPA 13 and/or OSHPD guidelines should be followed.

Lateral Brace

To Install — Place the Fig. 909 onto the bracing pipe. Tighten the set bolt until head bottoms out on surface. Attachment can pivot for adjustment to proper brace angle.

Finish — Plain

Note — Available in Electro-Galvanized and HDG finish.

Order By — Figure number, pipe size and finish.

Dimensions • Weights

Pipe Size	A	B	H*	Max. Design. Load Lbs.	Max. Design Load Lbs. w/Washer	Approx. Wt./100
1	6	1⅝	17/32	2015	2765	91

* Available with hole sizes to accommodate up to 3/4" fastener. Consult Factory.

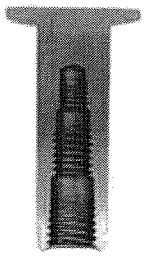
BLUE BANGER HANGER® *Cast-In-Place Internally Threaded Inserts*

SIMPSON StrongTie ANCHOR SYSTEMS

The Blue Banger Hanger is an internally threaded insert that is cast into the underside of concrete decks after being fastened to the top of wood forms or metal deck. Once the concrete has cured, the anchor provides an attachment point for threaded rod used to hang electrical, mechanical and plumbing utilities. The Blue Banger Hanger is the only insert to offer the patented multi thread design which allows one size insert to handle 2-3 diameters of threaded rod.

FEATURES:

- Quick and easy installation saves time and money- no assembly required.
- Patented multi-thread design allows each hanger to accept 2-3 diameters of threaded rod. Three sizes of hangers can handle all applications, reducing contractor and distributor inventories.
- Multi-thread design allows threaded rod size to be changed after the anchor is in the concrete.
- Machined steel insert with large flanged head provides high tension and shear loads for overhead attachments.
- Positive attachment to form keeps the hanger vertical and in the correct position.
- Internal threads eliminate the cost of rod couplers.
- No Equal "≠" head stamp allows easy identification before the concrete pour.

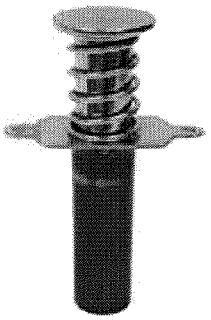


Patented multi-thread design allows one product to handle up to three rod diameters.

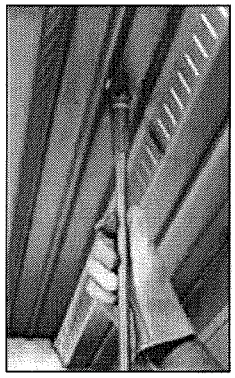
MATERIAL: Carbon steel

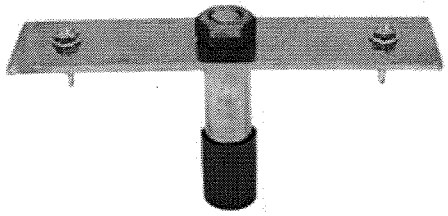
FINISH: Yellow zinc dichromate coating

CODES: Factory Mutual 3024378 (Except Roof Deck Insert); Underwriters Laboratories (Except Roof Deck Insert); See pipe size limit tables.



Blue Banger Hanger Metal Deck Insert
U.S. Patent 6,240,697B1

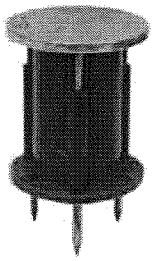




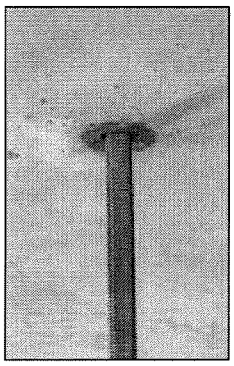
Blue Banger Hanger Roof Deck Insert
U.S. Patent 6,240,697B1

Blue Banger Hanger Product Data

Hanger Type	For Rod Diameter (in)	Deck Hole Diameter (in)	Model No.	Carton Qty.
Metal Deck Insert	1/4, 3/8, 1/2	13/16 - 7/8	BBMD2550	100
	3/8, 1/2, 5/8	1 1/8 - 1 3/16	BBMD3762	50
	5/8, 3/4	1 3/16 - 1 1/4	BBMD6275	50
Roof Deck Insert	1/4, 3/8, 1/2	7/8	BBRD2550	50
Wood Form Insert	1/4, 3/8, 1/2	N/A	BBWF2550	200
	3/8, 1/2, 5/8		BBWF3762	150
	5/8, 3/4		BBWF6275	150



Blue Banger Hanger Wood Form Insert
U.S. Patent 6,240,697B1



DRILL EXTENSIONS:

Drill extensions allow holes to be drilled for Blue Banger installation without having to repeatedly bend down. An ideal way to save installation time and reduce worker fatigue. Available for use with hole saws and step drills.

Drill Extensions

Description	Model No.
2' extension for use with hole saws	BBDEHS
2' extension for use with 3/8" shank step drills	BBDE37
2' extension for use with 1/2" shank step drills	BBDE50

Hole saws and step drills not included.

Step Drill Bit Extension (bit not included)

Hole Saw Bit Extension (bit not included)

BLUE BANGER HANGER® *Cast-In-Place Internally Threaded Inserts*

SIMPSON StrongTie ANCHOR SYSTEMS

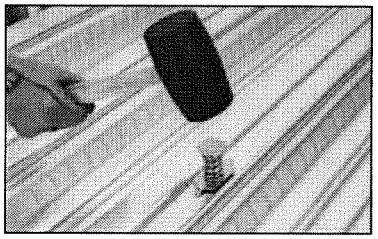
BLUE BANGER HANGER - METAL DECK INSERT

FEATURES:

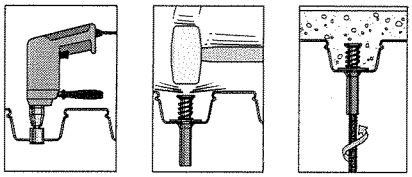
- 3" plastic sleeve keeps internal threads clean.
- Extended length of the sleeve allows easy location of the insert even with fireproofing on the underside of the deck. Also provides guidance to align threaded rod with the internal threads.
- Installed height of 2" allows the insert to be used on top of, or between, deck ribs.
- Compression spring keeps the insert perpendicular to the deck, even if it is bumped or stepped on after installation.
- Multi-thread design: Each insert accepts 2-3 rod diameters.

INSTALLATION:

- Drill a hole in the metal deck using the appropriate diameter bit as referenced in the table.
- Insert the hanger into the hole and strike the top so that the plastic sleeve is forced through the hole and expands against the bottom side of the deck. The anchor can also be installed by stepping on it.



Metal Deck Insert Installation Sequence



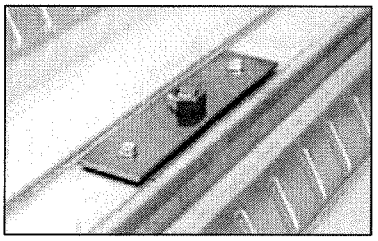
BLUE BANGER HANGER - METAL ROOF DECK INSERT

FEATURES:

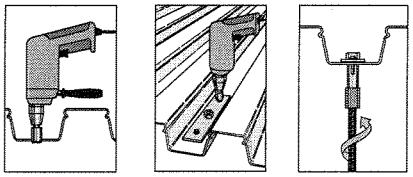
- Low profile design doesn't interfere with roofing material
- Plastic sleeve allows for easy identification and keeps internal threads clean.
- Positive attachment to the roof deck prevents spinning and keeps the hanger in position.
- Pre-staked screws allow quick installation.
- Multi-thread design: The insert accepts 3 rod diameters.

INSTALLATION:

- Drill a hole in the metal deck using the appropriate diameter bit as referenced in the table.
- Insert the hanger into the hole and fasten to the deck with the two pre-staked self drilling sheet metal screws provided.



Metal Roof Deck Insert Installation Sequence



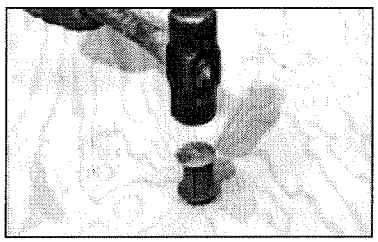
BLUE BANGER HANGER - WOOD FORM INSERT

FEATURES:

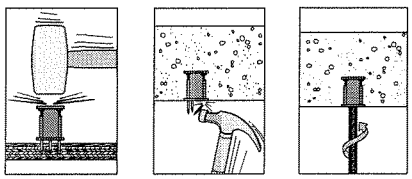
- Blue plastic ring acts as an insert locator when forms are removed.
- Plastic ring creates a countersunk recess to keep internal threads clean from concrete residue.
- Nails snap off with the swipe of a hammer after the forms are removed.
- Multi-thread design: Each insert accepts 2-3 rod diameters.

INSTALLATION:

- Strike the top of the hanger and drive the 3 mounting nails into the forming material until the bottom of the hanger is flush with the plywood. The hanger should be sitting 90° perpendicular to the forming material.
- Once concrete is hardened, and forms are stripped, strike the mounting nails to break them off.



Wood Form Insert Installation Sequence



BLUE BANGER HANGER® *Cast-In-Place Internally Threaded Inserts*

SIMPSON Strong-Tie ANCHOR SYSTEMS

Wood Form Insert: Tension Loads in Normal-Weight Concrete

Model No.	Threaded Rod Dia. in.	Embed. Depth in. (mm)	Min. Edge Dist. in. (mm)	Min. Spacing in. (mm)	Tension Load Based on Concrete Strength f'c >= 3,000 psi (20.7 Mpa) Ultimate lbs. (kN)	Tension Load Based on Concrete Strength f'c >= 3,000 psi (20.7 Mpa) Allowable lbs. (kN)	Tension Load Based on Rod Strength A307 (SAE 1018) Allowable lbs. (kN)
BBWF2550	1/4	2 (51)	7 (178)	8 (203)	6,820 (30.3)	1,705 (7.6)	940 (4.2)
	3/8						2,105 (9.4)
	1/2						3,750 (16.7)
BBWF3762	3/8	2 (51)	7 (178)	8 (203)	7,360 (32.7)	1,840 (8.2)	2,105 (9.4)
	1/2						3,750 (16.7)
	5/8						5,875 (26.1)
BBWF6275	5/8	2 (51)	7 (178)	8 (203)	7,420 (33.0)	1,855 (8.3)	5,875 (26.1)
	3/4						8,460 (37.6)

See notes below.

Wood Form Insert: Shear Loads in Normal-Weight Concrete

Model No.	Threaded Rod Dia. in.	Embed. Depth in. (mm)	Min. Edge Dist. in. (mm)	Min. Spacing in. (mm)	Shear Load Based on Concrete Strength f'c >= 3,000 psi (20.7 Mpa) Ultimate lbs. (kN)	Shear Load Based on Concrete Strength f'c >= 3,000 psi (20.7 Mpa) Allowable lbs. (kN)	Shear Load Based on Rod Strength A307 (SAE 1018) Allowable lbs. (kN)
BBWF2550	1/2	2 (51)	7 (178)	8 (203)	8,750 (38.9)	2,185 (9.7)	1,930 (8.6)
BBWF3762	5/8	2 (51)	7 (178)	8 (203)	10,700 (47.6)	2,675 (11.9)	3,025 (13.4)
BBWF6275	3/4	2 (51)	7 (178)	8 (203)	10,460 (46.5)	2,615 (11.6)	4,360 (19.4)

See notes below.

Wood Form Insert: Tension Loads in Lightweight Concrete

Model No.	Threaded Rod Dia. in.	Embed. Depth in. (mm)	Min. Edge Dist. in. (mm)	Min. Spacing in. (mm)	Tension Load Based on Concrete Strength f'c >= 3,000 psi (20.7 Mpa) Ultimate lbs. (kN)	Tension Load Based on Concrete Strength f'c >= 3,000 psi (20.7 Mpa) Allowable lbs. (kN)	Tension Load Based on Steel Strength A307 (SAE 1018) Allowable lbs. (kN)
BBWF2550	1/4	2 (51)	7 (178)	8 (203)	4,280 (19.0)	1,070 (4.8)	940 (4.2)
	3/8						2,105 (9.4)
	1/2						3,750 (16.7)
BBWF6275	5/8	2 (51)	7 (178)	8 (203)	4,400 (19.6)	1,100 (4.9)	5,875 (26.1)
	3/4						8,460 (37.6)

See notes below.

Wood Form Insert: Shear Loads in Lightweight Concrete

Model No.	Threaded Rod Dia. In.	Embed. Depth in. (mm)	Min. Edge Dist. in. (mm)	Min. Spacing in. (mm)	Shear Load Based on Concrete Strength f'c >= 3,000 psi (20.7 Mpa) Ultimate lbs. (kN)	Shear Load Based on Concrete Strength f'c >= 3,000 psi (20.7 Mpa) Allowable lbs. (kN)	Shear Load Based on Rod Strength A307 (SAE 1018) Allowable lbs. (kN)
BBWF2550	1/2	2 (51)	7 (178)	8 (203)	8,600 (38.2)	2,150 (9.6)	1,930 (8.6)
BBWF6275	3/4	2 (51)	7 (178)	8 (203)	9,260 (41.2)	2,315 (10.3)	4,360 (19.4)

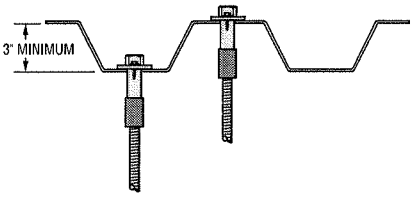
1. Allowable load must be the lesser of the concrete or steel strength.
2. The allowable loads based on concrete strength are based on a factor of safety of 4.0.
3. Allowable loads may not be increased for short-term loading due to wind or seismic forces.
4. Mechanical and plumbing design codes may prescribe lower allowable loads. Verify with local codes.

Roof Deck Insert: Tension Loads in Metal Deck

Model No.	Drill Bit Dia. in.	Threaded Rod Dia. in.	Allowable Tension Load lbs. (kN)
BBRD2550	13/16 - 7/8	1/4	300 (1.3)
		3/8	
		1/2	

1. The allowable loads are based on a factor of safety of 4.0.
2. Allowable loads may not be increased for short-term loading due to wind or seismic forces.
3. Acceptability of deck deflection due to imposed loads must be investigated separately.
4. Threaded rod strength must be investigated separately.
5. Anchors may be installed in the top or bottom flute of the metal deck.
6. Deck shall be 3" tall, 20 gauge minimum.

Typical Roof Deck Installation



*See page 7 for an explanation of the load table icons

Metal Deck Insert: Tension Loads in Normal-Weight or Lightweight Concrete over Metal Deck

Model No.	Drill Bit Dia. in.	Threaded Rod Dia. in.	Embed. Depth in. (mm)	Min. Edge Dist. in. (mm)	Min. Spacing in. (mm)	Tension Load Based on Concrete Strength (Install in High Flute) f'c >= 3,000 psi (20.7 Mpa) Ultimate lbs. (kN)	Tension Load Based on Concrete Strength (Install in High Flute) f'c >= 3,000 psi (20.7 Mpa) Allowable lbs. (kN)	Tension Load Based on Concrete Strength (Install in Low Flute) f'c >= 3,000 psi (20.7 Mpa) Ultimate lbs. (kN)	Tension Load Based on Concrete Strength (Install in Low Flute) f'c >= 3,000 psi (20.7 Mpa) Allowable lbs. (kN)	Tension Load Based on Rod Strength A307 (SAE 1018) Allowable lbs. (kN)
BBMD2550	13/16 - 7/8	1/4	2 (51)	7 1/2 (191)	8 (203)	9,320 (41.5)	2,330 (10.4)	5,740 (25.5)	1,435 (6.4)	940 (4.2)
		3/8								2,105 (9.4)
		1/2								3,750 (16.7)
BBMD3762	1 1/8 - 1 3/8	3/8	2 (51)	7 1/2 (191)	8 (203)	10,540 (46.9)	2,635 (11.7)	5,880 (26.2)	1,470 (6.5)	2,105 (9.4)
		1/2								3,750 (16.7)
		5/8								5,875 (26.1)
BBMD6275	1 3/16 - 1 3/8	5/8	2 (51)	7 1/2 (191)	8 (203)	12,360 (55.0)	3,090 (13.7)	6,060 (27.0)	1,515 (6.7)	5,875 (26.1)
		3/4								8,460 (37.6)

*See page 7 for an explanation of the load table icons

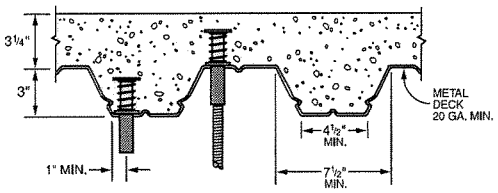
See notes below.

Metal Deck Insert: Shear Loads in Normal-Weight or Lightweight Concrete over Metal Deck

Model No.	Drill Bit Dia. in.	Threaded Rod Dia. in.	Embed. Depth in. (mm)	Min. Edge Dist. in. (mm)	Min. Spacing in. (mm)	Shear Load Based on Concrete Strength (Install in High Flute) f'c >= 3,000 psi (20.7 Mpa) Ultimate lbs. (kN)	Shear Load Based on Concrete Strength (Install in High Flute) f'c >= 3,000 psi (20.7 Mpa) Allowable lbs. (kN)	Shear Load Based on Concrete Strength (Install in Low Flute) f'c >= 3,000 psi (20.7 Mpa) Ultimate lbs. (kN)	Shear Load Based on Concrete Strength (Install in Low Flute) f'c >= 3,000 psi (20.7 Mpa) Allowable lbs. (kN)	Shear Load Based on Rod Strength A307 (SAE 1018) Allowable lbs. (kN)
BBMD2550	13/16 - 7/8	1/2	2 (51)	7 1/2 (191)	8 (203)	9,720 (43.2)	2,430 (10.8)	6,020 (26.8)	1,505 (6.7)	1,930 (8.6)
BBMD3762	1 1/8 - 1 3/8	5/8	2 (51)	7 1/2 (191)	8 (203)	9,400 (41.8)	2,350 (10.4)	6,580 (29.2)	1,645 (7.3)	3,025 (13.4)
BBMD6275	1 3/16 - 1 3/8	3/4	2 (51)	7 1/2 (191)	8 (203)	9,720 (43.2)	2,430 (10.8)	6,720 (29.9)	1,680 (7.5)	4,360 (19.4)

1. Allowable load must be the lesser of the concrete or rod strength.
2. The allowable loads based on concrete strength are based on a factor of safety of 4.0.
3. Allowable loads may not be increased for short-term loading due to wind or seismic forces.
4. Anchors may be installed off-center in the flute, up to 1" from the edge of flute.
5. Shear loads shall be applied flush with metal deck surface.
6. Deck shall be 20-gauge minimum.
7. Mechanical and plumbing design codes may prescribe lower allowable loads. Verify with local codes.

Typical Metal Deck Installation



Wood Form Insert: Factory Mutual and Underwriters Laboratories Pipe Size Limits

Model No.	Rod Dia. in.	FM Max. Nominal Pipe Size in.	UL Max. Nominal Pipe Size in.
BBWF2550	1/4	N/L	4
	3/8	4	4
	1/2	8	8
BBWF3762	3/8	4	4
	1/2	8	8
	5/8	N/L	8
BBWF6275	5/8	N/L	
	3/4		

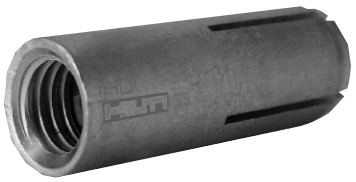
1. N/L = Not listed for this pipe size.

Metal Deck Insert: Factory Mutual & Underwriters Laboratories Pipe Size Limits

Model No.	Rod Dia. in.	FM Max. Nominal Pipe Size Install in High Flute in.	FM Max. Nominal Pipe Size Install in Low Flute in.	UL Max. Nominal Pipe Size Install in High Flute in.	UL Max. Nominal Pipe Size Install in Low Flute in.
BBMD2550	1/4	N/L	N/L	4	4
	3/8	4	4	4	4
	1/2	8	N/L	8	4
BBMD3762	3/8	4	4	4	4
	1/2	8	N/L	8	4
	5/8	N/L	N/L	8	4
BBMD6275	5/8	12	N/L	12	N/L
	3/4	12	N/L	12	N/L

1. N/L = Not listed for this pipe size.

4.3.8 HDI & HDI-L Drop-In Anchor



Listings/Approvals

ICC-ES (International Code Council)
ER-2895 (HDI Only)

COLA (City of Los Angeles)
Research Report No. 23709 (HDI Only)

FM (Factory Mutual)
Pipe Hanger Components for Automatic Sprinkler Systems (3/8" - 3/4") (HDI and HDI-L)

UL (Underwriters Laboratories)
UL 203 Pipe Hanger Equipment for Fire Protection Services (3/8" - 3/4")

4.3.8.1 Product Description

The Hilti HDI/HDI-L Drop-In anchor is an internally threaded, flush mounted expansion anchor for use in concrete.

Product Features

HDI

- Anchor, setting tool and Hilti drill bit form a matched tolerance system to provide reliable fastenings
- Below surface setting for easy patchwork
- Allows shallow embedment without sacrificing performance
- Lip provides flush installation, consistent anchor depth, and easy rod alignment (HDI-L)
- Lip allows accurate flush surface setting, independent of hole depth (HDI-L)
- Ideal for repetitive fastenings with threaded rods of equal length
- Intelligent expansion section adapts to the base material and reduces number of hammer blows up to 50% (HDI-L)

Guide Specifications

Expansion Anchor Expansion anchors shall be flush or shell type and zinc plated in accordance with ASTM B 633, SC 1, Type III. Anchors shall be Hilti HDI/HDI-L anchors as supplied by Hilti.

Installation Install shell or flush type anchors in holes drilled with Hilti carbide tipped drill bits. Install anchors as per manufacturer's recommendations.

4.3.8.2 Material Specifications

HDI/HDI-L, 1/4", 3/8", 1/2", and HDI 5/8" and 3/4" are manufactured from mild carbon steel which is plated with a zinc finish for corrosion protection in accordance with ASTM B 633, SC 1, Type III

HDI Stainless Steel material meets the requirements of AISI 303

4.3.8.3 Technical Data

HDI/HDI-L Specification Table

Details		Anchor Size	in. (mm)	HDI/HDI-L 1/4 (6.4)	HDI/HDI-L 3/8 (9.5)	HDI/HDI-L 1/2 (12.7)	HDI 5/8 (15.9)	HDI 3/4 (19.1)
d_{bit}	Bit diameter[1]		in.	3/8	1/2	5/8	27/32	1
h_{nom}	Std. depth of embed.		in.	1	1-9/16	2	2-9/16	3-3/16
ℓ	Anchor length		(mm)	(25)	(40)	(51)	(65)	(81)
h_1	Hole depth							
ℓ_{th}	Useable thread length		in. (mm)	7/16 (11)	5/8 (15)	11/16 (17)	7/8 (22)	1-3/8 (34)
	Threads per inch			20	16	13	11	10
h	min. base material thickness		in. (mm)	3 (76)	3-1/8 (79)	4 (102)	5-1/8 (130)	6-3/8 (162)
T_{max}	max. tightening torque		ft-lb (Nm)	4 (5.4)	11 (14.9)	22 (29.8)	37 (50.2)	80 (108.5)

1 For Hilti matched tolerance carbide tipped drill bits, see section 8.4.1.

Combined Shear and Tension Loading

$$\left(\frac{N_d}{N_{rec}}\right)^{5/3} + \left(\frac{V_d}{V_{rec}}\right)^{5/3} \leq 1.0 \text{ (Ref. Section 4.1.8.3)}$$

HDI & HDI-L Drop-In Anchor 4.3.8

Carbon Steel HDI Allowable Loads in Concrete

Anchor size in. (mm)	2000 psi (13.8 MPa)				4000 psi (27.6 MPa)				6000 psi (41.4 MPa)			
	Tension lb (kN)		Shear lb (kN)		Tension lb (kN)		Shear lb (kN)		Tension lb (kN)		Shear lb (kN)	
	HDI	HDI-L	HDI	HDI-L	HDI	HDI-L	HDI	HDI-L	HDI	HDI-L	HDI	HDI-L
1/4 (6.4)	500 (2.2)	500 (2.2)	450 (8.0)	450 (8.0)	570 (2.5)	570 (2.5)	625 (2.8)	625 (2.8)	790 (3.5)	790 (3.5)	700 (3.1)	700 (3.1)
3/8 (9.5)	890 (4.0)	890 (4.0)	965 (4.3)	965 (4.3)	1115 (5.0)	1115 (5.0)	1250 (5.6)	1250 (5.6)	1360 (6.0)	1360 (6.0)	1500 (6.7)	1500 (6.7)
1/2 (12.7)	1120 (5.0)	1120 (5.0)	1500 (6.7)	1500 (6.7)	1785 (7.9)	1785 (7.9)	2125 (9.5)	1940 (8.6)	2345 (10.4)	2345 (10.4)	2500 (11.1)	2500 (11.1)
5/8 (15.9)	1875 (8.3)	–	2500 (11.1)	–	2920 (13.0)	–	3250 (14.5)	–	3715 (16.5)	–	3750 (16.7)	–
3/4 (19.1)	2500 (11.1)	–	3875 (17.2)	–	4065 (18.1)	–	5000 (22.2)	–	5565 (24.8)	–	5500 (24.5)	–

Note: The ultimate shear and allowable shear values are based on the use of SAE Grade 5 bolts, (f_y = 85 ksi, F_{ult} = 120 ksi) with the exception of the 1/4" HDI/HDI-L in f'_c = 6000 psi concrete which is based upon the use of a SAE Grade 8 bolt (f_y = 120 ksi, F_{ult} = 150 ksi).

Carbon Steel HDI Ultimate Loads in Concrete

Anchor size in. (mm)	2000 psi (13.8 MPa)				4000 psi (27.6 MPa)				6000 psi (41.4 MPa)			
	Tension lb (kN)		Shear lb (kN)		Tension lb (kN)		Shear lb (kN)		Tension lb (kN)		Shear lb (kN)	
	HDI	HDI-L	HDI	HDI-L	HDI	HDI-L	HDI	HDI-L	HDI	HDI-L	HDI	HDI-L
1/4 (6.4)	1995 (8.9)	1995 (8.9)	1800 (8.0)	1800 (8.0)	2270 (10.1)	2270 (10.1)	2500 (11.1)	2500 (11.1)	3150 (14.0)	3150 (14.0)	2800 (12.5)	2800 (12.5)
3/8 (9.5)	3555 (15.8)	3555 (15.8)	3850 (17.1)	3850 (17.1)	4460 (19.8)	4460 (19.8)	5000 (22.2)	5000 (22.2)	5430 (24.2)	5430 (24.2)	6000 (26.7)	6000 (26.7)
1/2 (12.7)	4470 (19.9)	4470 (19.9)	6000 (26.7)	6000 (26.7)	7140 (31.8)	7140 (31.8)	8500 (37.8)	7750 (34.4)	9375 (41.7)	9375 (41.7)	10000 (44.5)	10000 (44.5)
5/8 (15.9)	7500 (33.4)	–	10000 (44.5)	–	11685 (52.0)	–	13000 (57.8)	–	14865 (66.1)	–	15000 (66.7)	–
3/4 (19.1)	10000 (44.5)	–	15500 (69.0)	–	16260 (72.3)	–	20000 (89.0)	–	22250 (99.0)	–	22000 (97.9)	–

Carbon Steel HDI Allowable Loads in Lightweight Concrete and Lightweight Concrete over Metal Deck[1, 2]

Anchor Size in. (mm)	Anchor Installed in 3000 psi (20.7 MPa) Lt. Wt. Concrete[3]		Anchor Installed Through Steel Deck Upper Flute Into 3000 psi (20.7 MPa) Lt. Wt. Concrete[4]		Anchor Installed Through Steel Deck Lower Flute Into 3000 psi (20.7 MPa) Lt. Wt. Concrete[4]	
	Tension, lb (kN)	Shear, lb (kN)	Tension, lb (kN)	Shear, lb (kN)	Tension, lb (kN)	Shear, lb (kN)
1/4 (6.4)	465 (2.1)	340 (1.5)	530 (2.4)	335 (1.5)	375 (1.7)	250 (1.1)
3/8 (9.5)	755 (3.4)	940 (4.2)	880 (3.9)	1010 (4.5)	500 (2.2)	500 (2.2)
1/2 (12.7)	1135 (5.0)	1700 (7.6)	1105 (4.9)	1755 (7.8)	625 (2.8)	750 (3.3)
5/8 (15.9)	1465 (6.5)	2835 (12.6)	–	–	875 (3.9)	875 (3.9)
3/4 (19.1)	2075 (9.2)	3680 (16.4)	–	–	1250 (5.5)	1000 (4.4)

1 The allowable values are based on the use of SAE Grade 2 bolts installed in the anchors.

2 Based on using a safety factor of 4.0.

3 The tabulated shear and tensile values are for anchors installed in structural lightweight concrete having the designated ultimate compressive strength at the time of installation. The concrete must comply with ASTM C 330-77.

4 The tabulated shear and tensile values are for anchors installed through 20 gauge intermediate decking into structural lightweight concrete having the designated ultimate strength at the time of installation. The concrete must comply with ASTM C 330-77.

Stainless Steel HDI Allowable Loads in Concrete

Anchor size in. (mm)	4000 psi (27.6 MPa)		6000 psi (41.4 MPa)	
	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)
SS HDI – 1/4 (6.4)	480 (2.1)	600 (2.7)	740 (3.3)	600 (2.7)
SS HDI – 3/8 (9.5)	1040 (4.6)	1230 (5.5)	1460 (6.5)	1230 (5.5)
SS HDI – 1/2 (12.7)	1840 (8.2)	2760 (12.4)	2410 (10.7)	2760 (12.3)
SS HDI – 5/8 (15.9)	2630 (11.7)	4510 (20.1)	3770 (16.8)	4510 (20.1)
SS HDI – 3/4 (19.1)	3830 (17.0)	5580 (24.8)	5030 (22.4)	5580 (24.8)

Note: The ultimate and allowable shear values are based on the use of Type 18-8 bolts.

Stainless Steel HDI Ultimate Loads in Concrete

Anchor size in. (mm)	4000 psi (27.6 MPa)		6000 psi (41.4 MPa)	
	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)
SS HDI – 1/4 (6.4)	1930 (8.6)	2400 (10.7)	2950 (13.1)	2400 (10.7)
SS HDI – 3/8 (9.5)	4170 (18.5)	4920 (21.9)	5850 (26.0)	4920 (21.9)
SS HDI – 1/2 (12.7)	7350 (32.7)	11040 (49.1)	9630 (42.8)	11040 (49.1)
SS HDI – 5/8 (15.9)	10540 (46.9)	18040 (80.2)	15100 (67.2)	18040 (80.2)
SS HDI – 3/4 (19.1)	15340 (68.2)	22320 (99.3)	20130 (89.5)	22320 (99.3)

4.3.8 HDI & HDI-L Drop-In Anchor

Anchor Spacing and Edge Distance Guidelines (See Anchoring Technology Section 4.1.3)

Anchor Spacing Adjustment Factors

s = Actual Spacing

s_{min} = 2.0 h_{nom}

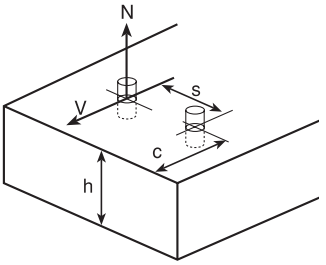
s_{cr} = 3.5 h_{nom}

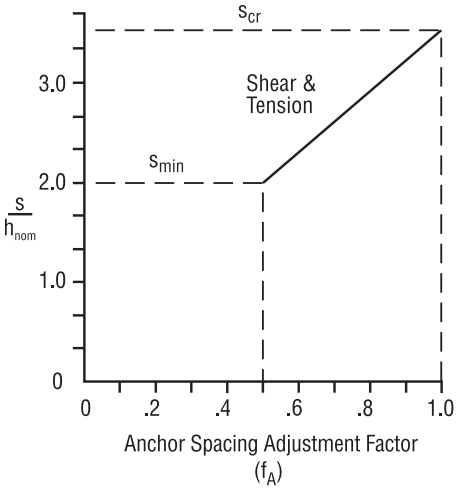
Edge Distance Adjustment Factors

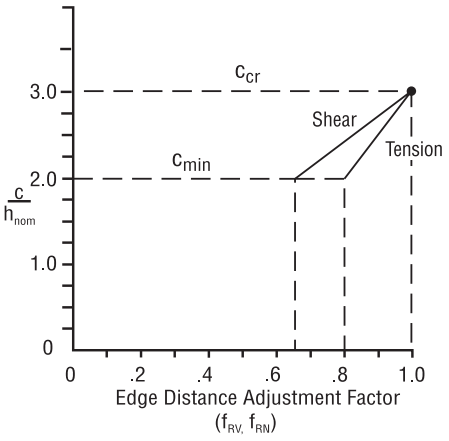
c = Actual edge distance

c_{min} = 2.0 h_{nom}

c_{cr} = 3.0 h_{nom}







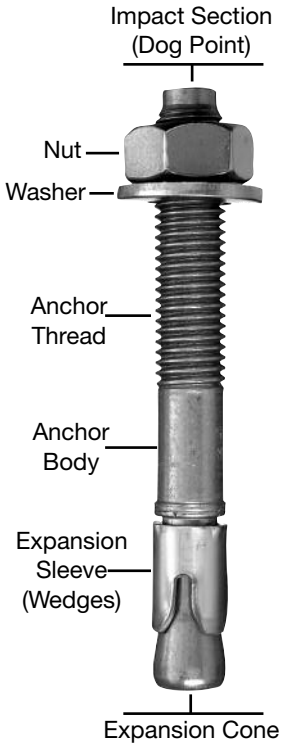
Influence of Anchor Spacing & Edge Distance f_A, f_R

Anchor Size in. (mm)	h_{nom} in. (mm)
1/4 (6.4)	**1** (25)
3/8 (9.5)	**1-9/16** (40)
1/2 (12.7)	**2** (51)
5/8 (15.8)	**2-9/16** (65)
3/4 (19.1)	**3-3/16** (81)

h_{nom} = standard embedment depth

Load Adjustment Factors (Anchor Spacing) f_A						Load Adjustment Factors (Edge Distance) f_R											
Tension/Shear Loads						Tension, f_{RN}						Shear, f_{RV}					
Spacing s in. (mm)	Anchor Diameter					Edge Distance c in. (mm)	Anchor Diameter					Anchor Diameter					
	1/4	3/8	1/2	5/8	3/4		1/4	3/8	1/2	5/8	3/4	1/4	3/8	1/2	5/8	3/4
2 (51)	.50					**2** (51)	.80					.65				
2-1/2 (64)	.67					**2-1/2** (64)	.90					.83				
3 (76)	.83	.50				**3** (76)	1.0	.80				1.0	.65			
3-1/2 (89)	1.0	.58				**3-1/2** (89)		.85					.73			
4 (102)		.69	.50			**4** (102)		.91	.80				.85	.65		
4-1/2 (114)		.79	.58			**4-1/2** (114)		.98	.85				.96	.74		
5 (127)		.90	.67	.50		**5** (127)		1.0	.90	.80			1.0	.83	.65	
5-1/2 (140)		1.0	.75	.55		**5-1/2** (140)			.95	.83				.91	.70	
6 (152)			.83	.61	.50	**6** (152)			1.0	.87				1.0	.77	
7 (178)			1.0	.74	.57	**6-1/2** (165)				.91	.80				.84	.65
8 (203)				.87	.67	**7** (178)				.95	.84				.91	.72
9 (229)				1.0	.77	**8** (203)				1.0	.90				1.0	.83
10 (254)					.88	**9** (229)					.96					.94
11 (279)					.98	**10** (254)					1.0					1.0
12 (305)					1.0											
s_{min} = 2.0 h_{nom}, s_{cr} = 3.5 h_{nom} $f_A = 0.33 \frac{s}{h_{nom}} - 0.17$ for $s_{cr} > s > s_{min}$						c_{min} = 2.0 h_{nom}, c_{cr} = 3.0 h_{nom} $f_{RN} = 0.2 \frac{c}{h_{nom}} + 0.4$ for $c_{cr} > c > c_{min}$						c_{min} = 2.0 h_{nom}, c_{cr} = 3.0 h_{nom} $f_{RV} = 0.35 \frac{c}{h_{nom}} - 0.05$ for $c_{cr} > c > c_{min}$				

4.3.5 Kwik Bolt 3 Expansion Anchor



Listings/Approvals

ICC-ES (International Code Council)
ESR-1385 Seismically recognized under AC01 dated April 2002

City of Los Angeles (COLA)
Underwriters Laboratories (UL)

UL (Underwriters Laboratories)
UL 203 Pipe Hanger Equipment for Fire Protection Services (3/8" - 3/4")

Factory Mutual (FM)
Pipe Hanger Components for Automatic Sprinkler (3/8" - 3/4")

Miami-Dade County
NOA No. 06-0810.13

Qualified under an NQA-1 Nuclear Quality Program

*Please refer to the reports to verify that the type and diameter specified is included

4.3.5.1 Product Description

The Kwik Bolt 3 (KB3) is a torque controlled expansion anchor, which provides consistent performance for a wide range of mechanical anchor applications. This anchor series is available in carbon steel with zinc electroplated coating, carbon steel with hot-dip galvanized coating, 304 stainless steel and 316 stainless steel versions.The threaded stud version of the anchor is available in a variety of diameters ranging from 1/4 in. to 1 in. depending on the steel and coating type. Applicable base materials include normal-weight concrete, structural lightweight concrete, lightweight concrete over metal deck, and grout filled concrete masonry.

Guide Specifications

Torque controlled expansion anchors shall be Kwik Bolt 3 supplied by Hilti meeting the description in Federal specification A-A 1923A, Type 4. The anchor bears a length identification mark embossed into the impact section (dog point) of the anchor identifying the anchor as a Hilti Kwik Bolt 3 in the installed condition. Anchors are manufactured to meet one of the following conditions:

1. The carbon steel anchor body, nut and washer have an electroplated zinc coating conforming to ASTM B 633 to a minimum thickness of 5 μm.
2. The carbon steel hot-dip galvanized anchor body, nut, and washer conform to ASTM A 153. The stainless steel expansion elements conform to either AISI 304 or AISI 316.
3. The stainless steel anchor body, nut, and washer conform to AISI 304. The stainless steel expansion elements conform to either AISI 304 or AISI 316.
4. The stainless steel anchor body, nut, and washer conform to AISI 316. The stainless steel expansion elements conform to AISI 316.

Product Features

- Length identification code facilitates quality control and inspection after installation.
- Through fixture installation and variable thread lengths improve productivity and accommodate various base plate thicknesses.
- Raised impact section (Dog Point) prevents thread damage during installation.
- Anchor size is same as drill bit size for easy installation. For temporary applications anchors may be driven into drilled holes after usage.
- Mechanical expansion allows immediate load application.

Installation

Drill hole in concrete, structural lightweight concrete, or grout filled concrete masonry using a Hilti carbide tipped drill bit and a Hilti rotary hammer drill. Remove dust from the hole with oil free compressed air or vacuum. Alternately for 1/2, 5/8, 3/4, and 1 inch diameter Kwik Bolt 3 anchors, the hole may be drilled using a matched tolerance Hilti DD-C wet diamond core bit for anchoring applications. The slurry must be flushed from the diamond cored hole prior to anchor installation. The minimum hole depth must exceed the anchor embedment prior to torquing by one hole, diameter. Drive the anchor into the hole using a hammer. A minimum of six threads must be below the surface of the fixture. Tighten the nut to the recommended installation torque.

4.3.5.2 Material Specifications

Carbon steel with electroplated zinc

All Carbon Steel Kwik Bolt 3, Long Thread Kwik Bolt 3 and Rod Coupling Anchors, excluding the 3/4 x 12 and 1 inch diameter sizes, have the minimum tensile bolt fracture loads shown in Table 1.

All carbon steel 3/4 x 12 and 1 inch diameter sizes and carbon steel countersunk Kwik Bolt 3 anchor bodies have mechanical properties as listed in Table 1.

Carbon steel anchor components plated in accordance with ASTM B 633 to a minimum thickness of 5 µm.

Nuts conform to the requirements of ASTM A 563, Grade A, Hex.

Washers meet the requirements of ASTM F 844.

Expansion elements (wedges) are manufactured from carbon steel, except the following anchors have stainless steel wedges:

- All 1/4 inch diameter anchors
- KB3 3/4x12
- All 1 inch diameter anchors
- All countersunk Kwik Bolt 3

Carbon steel with hot-dip galvanized coating

Anchor bodies manufactured from carbon steel have the minimum tensile bolt fracture loads shown in Table 1.

Carbon steel anchor components hot-dip galvanized according to ASTM A 153, Class C (43 µm min.).

Nuts conform to the requirements of ASTM A 563, Grade A, Hex.

Washers meet the requirements of ASTM F 844.

Stainless steel expansion elements (wedges) are manufactured from either AISI 304 or AISI 316.

Stainless steel

Anchor bodies smaller than 3/4 inch, excluding all Countersunk Kwik Bolt 3 anchors, are produced from AISI 304 or 316 stainless steel having the minimum bolt fracture loads shown in Table 1.

Anchor bodies 3/4 inch and larger, and all stainless steel Countersunk Kwik Bolt 3 anchor bodies, are produced from AISI 304 or 316 stainless steel have the minimum mechanical properties shown in Table 1.

Nuts meet the dimensional requirements of ASTM F 594.

Washers meet the dimensional requirements of ANSI B18.22.1, Type A, plain.

Stainless steel expansion elements for AISI 304 anchors are made from either AISI 304 or AISI 316. Stainless steel expansion elements for AISI 316 anchors are made from AISI 316. All stainless steel nuts and washers for AISI 304 and 316 anchors are manufactured from AISI 304 and 316, respectively.

Combined Shear and Tension Loading

$$\left(\frac{N_d}{N_{rec}}\right)^{5/3} + \left(\frac{V_d}{V_{rec}}\right)^{5/3} \leq 1.0$$ (Ref. Section 4.1.8.3)

4.3.5 Kwik Bolt 3 Expansion Anchor

4.3.5.3 Technical Data

Table 1 - Kwik Bolt 3 Specifications[1]

Details \ Bolt Size			in. (mm)	1/4 (6.4)			3/8 (9.5)			1/2 (12.7)		
d_{bit}	nominal bit diameter[2]		in.	1/4			3/8			1/2		
$h_{min}/h_{nom}/h_{deep}$	depth of embedment		in. (mm)	1-1/8 (29)	2 (51)	3 (76)	1-5/8 (41)	2-1/2 (64)	3-1/2 (89)	2-1/4 (57)	3-1/2 (89)	4-3/4 (121)
h_o	minimum/standard/deep hole depth		in. (mm)	1-3/8 (35)	2-1/4 (57)	3-1/4 (83)	2 (51)	2-7/8 (73)	3-7/8 (89)	2-3/4 (70)	4 (102)	5-1/4 (133)
d_h	wedge clearance hole in fixture		in. (mm)	5/16 (8)			7/16 (11)			9/16 (14)		
T_{inst} Recommended Installation Torque	Normal weight & Light weight Concrete	Carbon Steel HDG	ft-lb (Nm)	4 (5)			20 (27)			40 (54)		
		Stainless Steel	ft-lb (Nm)	6 (8)			20 (27)			40 (54)		
	Grout Filled Block	Carbon Steel	ft-lb (Nm)	4 (5)			15 (20)			25 (34)		
h	min. base material thickness		in.	3 inch (76 mm) or 1.3 times embedment, whichever number is greater								
Bolt Fracture Load	Carbon Steel			2900 lb[4,6]			7200 lb[4,6]			12400 lb[4]		
	HDG			no offering			no offering			12400 lb[4]		
	Stainless steel			2900 lb[4,7]			7200 lb[4,7]			12400 lb[4]		

Details \ Bolt Size			in. (mm)	5/8 (15.9)			3/4 (19.1)			1 (25.4)		
d_{bit}	nominal bit diameter[2]		in.	5/8			3/4			1		
$h_{min}/h_{nom}/h_{deep}$	minimum/standard/deep depth of embedment		in. (mm)	2-3/4 (70)	4 (102)	5-1/2 (140)	3-1/4 (83)	4-3/4 (121)	6-1/2[3] (165)	4-1/2 (114)	6 (152)	9 (229)
h_o	minimum/standard/deep hole depth		in. (mm)	3-3/8 (86)	4-5/8 (117)	6-1/8 (156)	4 (102)	5-1/2 (140)	6-4/5 (173)	5-1/2 (140)	7 (178)	10 (254)
d_h	wedge clearance hole in fixture		in. (mm)	11/16 (17)			13/16 (21)			1-1/8 (29)		
T_{inst} Recommended Installation Torque	Normal weight & Light weight Concrete	Carbon Steel HDG	ft-lb (Nm)	85 (115)			150 (203)			250 (339)		
		Stainless Steel	ft-lb (Nm)	85 (115)			150 (203)			235 (319)		
	Grout Filled Block	Carbon Steel	ft-lb (Nm)	65 (88)			120 (1663)			-		
h	min. base material thickness		in.	3 inch (76 mm) or 1.3 times embedment, whichever number is greater								
Bolt Fracture Load	Carbon Steel			19600 lb[4]			28700 lb[4,8]			$f_{ut} \geq 88$ ksi, $f_y \geq 75$ ksi[5]		
	HDG			19600 lb[4]			28700 lb[4]			no offering		
	Stainless steel			21900 lb[4]			$f_{ut} \geq 76$ ksi, $f_y \geq 64$ ksi[5]			$f_{ut} \geq 76$ ksi, $f_y \geq 64$ ksi[5]		

1 See Kwik Bolt 3 Product Line Table in Section 4.5.3.3 for a full list and anchor length and thread length configurations.

2 Loads for Kwik Bolt 3 are applicable for both carbide drill bits (see Section 8.4.1) and matched tolerance Hilti DD-C diamond core bits in sizes ranging from 1/2 inch to 1 inch.

3 The deep embedment depth for stainless steel Kwik Bolt 3 anchors is 8 inch (203 mm).

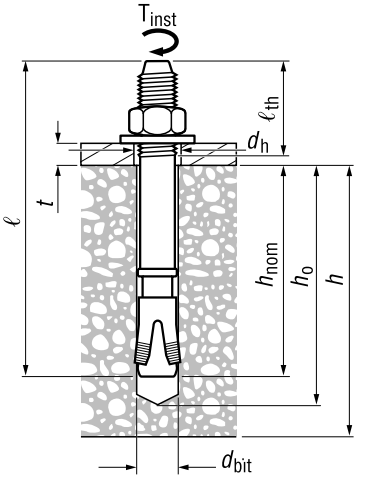
4 Bolt fracture loads are determined by testing in a jig as part of product quality control. These values are not intended for design purposes.

5 Bolt strength specified by minimum tensile and yield strength. Bolt fracture load not applicable.

6 Bolt fracture load not applicable to carbon steel Countersunk Kwik Bolt 3. The tensile and yield strengths are, $f_{ut} \geq 105$ ksi and $f_y \geq 90$ ksi.

7 Bolt fracture load not applicable to stainless steel Countersunk Kwik Bolt 3. The tensile and yield strengths are, $f_{ut} \geq 90$ ksi and $f_y \geq 76$ ksi.

8 For 3/4 x 12, $f_{ut} \geq 88$ ksi and $f_y \geq 75$ ksi. Bolt fracture load not applicable.



Kwik Bolt 3 Expansion Anchor 4.3.5

Table 2 - Carbon Steel Kwik Bolt 3 Allowable Loads in Normal-Weight Concrete[1]

Anchor Diameter in. (mm)	Embedment Depth in. (mm)	f'_c = 2000 psi (13.8 MPa)		f'_c = 3000 psi (20.7 MPa)		f'_c = 4000 psi (27.6 MPa)		f'_c = 6000 psi (41.4 MPa)	
		Tension lb (kN)	Shear[2] lb (kN)	Tension lb (kN)	Shear[2] lb (kN)	Tension lb (kN)	Shear[2] lb (kN)	Tension lb (kN)	Shear[2] lb (kN)
1/4 (6.4)	1-1/8 (29)	300 (1.3)	530 (2.4)	365 (1.6)	530 (2.4)	430 (1.9)	530 (2.4)	550 (2.4)	530 (2.4)
	2 (51)	635 (2.8)		715 (3.2)		800 (3.6)		845 (3.8)	
	3 (76)	755 (3.4)		795 (3.5)		840 (3.7)			
3/8 (9.5)	1-5/8 (41)	730 (3.2)	1135 (5.0)	910 (4.0)	1275 (5.7)	1095 (4.9)	1420 (6.3)	1090 (4.8)	1460[3] (6.5)
	2-1/2 (64)	1260 (5.6)	1460[3] (6.5)	1555 (6.9)	1460[3] (6.5)	1850 (8.2)	1460[3] (6.5)	2060 (9.2)	
	3-1/2 (89)	1580 (7.0)		1770 (7.9)		1965 (8.7)		2150 (9.6)	
1/2 (12.7)	2-1/4 (57)	1235 (5.5)	1865 (8.3)	1430 (6.4)	2300 (10.2)	1620 (7.2)	2735[4] (12.2)	1975 (8.8)	3020[5] (13.4)
	3-1/2 (89)	1930 (8.6)	3020[5] (13.4)	2185 (9.7)	3020[5] (13.4)	2440 (10.9)	3020[5] (13.4)	3240 (14.4)	
	4-3/4 (121)	2135 (9.5)		2355 (10.5)		2575 (11.5)		3620 (16.1)	
5/8 (15.9)	2-3/4 (70)	1920 (8.5)	2750 (12.2)	2065 (9.2)	3410 (15.2)	2210 (9.8)	4070[6] (18.1)	2830 (12.6)	4885[5] (21.7)
	4 (102)	2660 (11.8)	4885[5] (21.7)	3020 (13.4)	4885[5] (21.7)	3385 (15.1)	4885[5] (21.7)	4770 (21.2)	
	5-1/2 (140)	3285 (14.6)		3695 (16.4)		4100 (18.2)		5325 (23.7)	
3/4 (19.1)	3-1/4 (83)	2120 (9.4)	4090 (18.2)	2425 (10.8)	4900 (21.8)	2730 (12.1)	5710[6] (25.4)	3785 (16.8)	5710[6] (25.4)
	4-3/4 (121)	3240 (14.4)	5340 (23.8)	4260 (18.9)	5340 (23.8)	5285 (23.5)	7325[7] (32.6)	6155 (27.4)	7325[8] (32.6)
	6-1/2 (165)	4535 (20.2)		5860 (26.1)		7185 (32)		7005 (31.2)	
1 (25.4)	4-1/2 (114)	3330 (14.8)	7070 (31.4)	4050 (18.0)	7600 (33.8)	4670 (20.8)	8140 (36.2)	5070 (22.6)	9200 (40.9)
	6 (152)	4930 (21.9)	9200 (40.9)	6000 (26.7)	9200 (40.9)	7070 (31.4)	9200 (40.9)	8400 (37.4)	
	9 (229)	6670 (29.7)		7670 (34.1)		8670 (38.6)		10670 (47.5)	

1 Intermediate load values for other concrete strengths and embedments can be calculated by linear interpolation.

2 Unless otherwise noted, values shown are valid for the shear plane acting through either the anchor body or the anchor threads.

3 Values shown are for a shear plane through the anchor body. When the shear plane is acting through the threads, reduce the shear value by 10%.

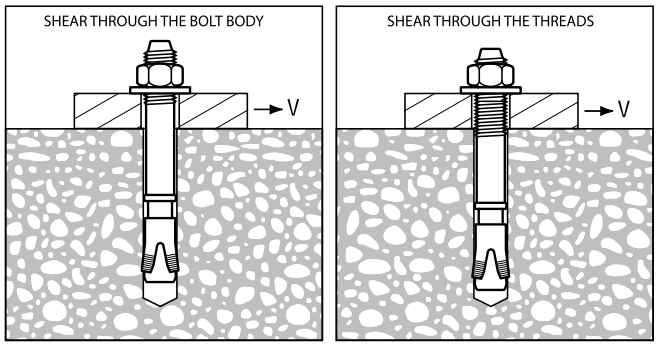
4 Values shown are for a shear plane through the anchor body. When the shear plane is acting through the threads, reduce the shear value by 12%.

5 Values shown are for a shear plane through the anchor body. When the shear plane is acting through the threads, reduce the shear value by 20%.

6 Values shown are for a shear plane through the anchor body. When the shear plane is acting through the threads, reduce the shear value by 7%.

7 Values shown are for a shear plane through the anchor body. When the shear plane is acting through the threads, reduce the shear value by 25%.

8 Values shown are for a shear plane through the anchor body. When the shear plane is acting through the threads, reduce the shear value by 15%.



4.3.5 Kwik Bolt 3 Expansion Anchor

Table 3 - Carbon Steel Kwik Bolt 3 Ultimate Loads in Normal-Weight Concrete[1]

Anchor Diameter in. (mm)	Embedment Depth in. (mm)	f'_c = 2000 psi (13.8 MPa)		f'_c = 3000 psi (20.7 MPa)		f'_c = 4000 psi (27.6 MPa)		f'_c = 6000 psi (41.4 MPa)	
		Tension lb (kN)	Shear[2] lb (kN)	Tension lb (kN)	Shear[2] lb (kN)	Tension lb (kN)	Shear[2] lb (kN)	Tension lb (kN)	Shear[2] lb (kN)
1/4 (6.4)	1-1/8 (29)	1120 (5.0)	1995 (8.9)	1370 (6.1)	1995 (8.9)	1615 (7.2)	1995 (8.9)	2060 (9.2)	1995 (8.9)
	2 (51)	2375 (10.5)		2690 (12.0)		3000 (13.3)		3165 (14.1)	
	3 (76)	2830 (12.6)		2990 (13.3)		3150 (14.0)			
3/8 (9.5)	1-5/8 (41)	2740 (12.2)	4250 (18.9)	3420 (15.2)	4790 (21.3)	4100 (18.2)	5328 (23.7)	4095 (18.2)	5475[3] (24.4)
	2-1/2 (64)	4720 (21.0)	5475[3] (24.4)	5830 (25.9)	5475[3] (24.4)	6935 (30.8)	5475[3] (24.4)	7730 (34.4)	
	3-1/2 (89)	5925 (26.4)		6645 (29.6)		7365 (32.8)		8055 (35.8)	
1/2 (12.7)	2-1/4 (57)	4635 (20.6)	7000 (31.1)	5355 (23.8)	8630 (38.4)	6075 (27.0)	10260[4] (45.6)	7410 (33.0)	11330[5] (50.4)
	3-1/2 (89)	7240 (32.2)	11330[5] (50.4)	8195 (36.5)	11330[5] (50.4)	9145 (40.7)	11330[5] (50.4)	12140 (54.0)	
	4-3/4 (121)	8000 (35.6)		8830 (39.3)		9655 (42.9)		13585 (60.4)	
5/8 (15.9)	2-3/4 (70)	7210 (32.1)	10315 (45.9)	7750 (34.5)	12790 (56.9)	8285 (36.9)	15265[6] (67.9)	10615 (47.2)	18315[5] (81.5)
	4 (102)	9975 (44.4)	18315[5] (81.5)	11335 (50.4)	18315[5] (81.5)	12690 (56.4)	18315[5] (81.5)	17890 (79.6)	
	5-1/2 (140)	12315 (54.8)		13850 (61.6)		15385 (68.4)		19970 (88.8)	
3/4 (19.1)	3-1/4 (83)	7955 (35.4)	15335 (68.2)	9100 (40.5)	18375 (81.7)	10245 (45.6)	21410[6] (95.2)	14185 (63.1)	21410[6] (95.2)
	4-3/4 (121)	12150 (54.0)	20030 (89.1)	15985 (71.1)	20030 (89.1)	19820 (86.2)	27475[7] (122.2)	23085 (102.7)	27475[8] (122.2)
	6-1/2 (165)	17000 (75.6)		21970 (97.7)		26935 (119.8)		26260 (116.8)	
1 (25.4)	4-1/2 (114)	12500 (55.6)	26500 (117.9)	15200 (67.6)	28500 (126.8)	17500 (77.8)	30500 (135.7)	19000 (84.5)	34500 (153.5)
	6 (152)	18500 (82.3)	34500 (153.5)	22500 (100.1)	34500 (153.5)	26500 (117.9)	34500 (153.5)	31500 (140.1)	
	9 (229)	25000 (111.2)		28750 (127.9)		32500 (144.6)		40000 (177.9)	

1 Intermediate load values for other concrete strengths and embedments can be calculated by linear interpolation.

2 Unless otherwise noted, values shown are valid for the shear plane acting through either the anchor body or the anchor threads.

3 Values shown are for a shear plane through the anchor body. When the shear plane is acting through the threads, reduce the shear value by 10%.

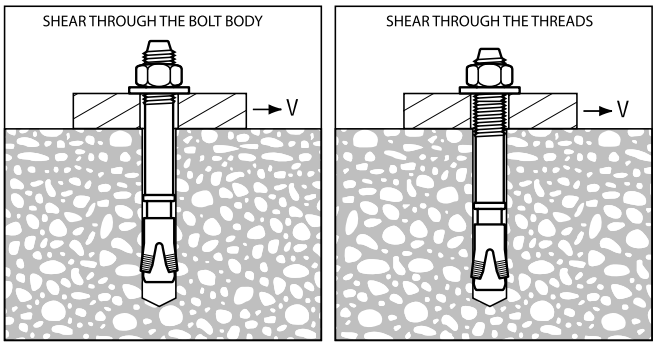
4 Values shown are for a shear plane through the anchor body. When the shear plane is acting through the threads, reduce the shear value by 12%.

5 Values shown are for a shear plane through the anchor body. When the shear plane is acting through the threads, reduce the shear value by 20%.

6 Values shown are for a shear plane through the anchor body. When the shear plane is acting through the threads, reduce the shear value by 7%.

7 Values shown are for a shear plane through the anchor body. When the shear plane is acting through the threads, reduce the shear value by 25%.

8 Values shown are for a shear plane through the anchor body. When the shear plane is acting through the threads, reduce the shear value by 15%.



Kwik Bolt 3 Expansion Anchor 4.3.5

Table 4 - Stainless Steel Kwik Bolt 3 Allowable Loads in Normal-Weight Concrete[1]

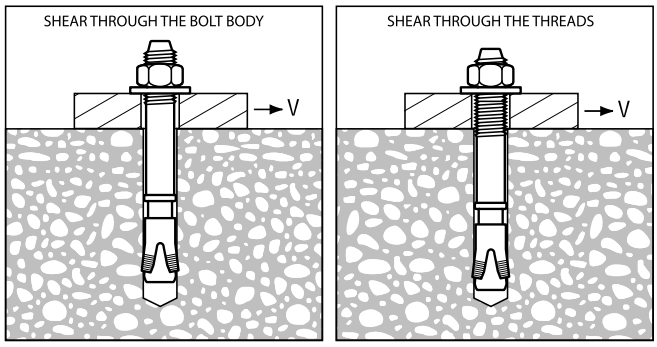
Anchor Diameter in. (mm)	Embedment Depth in. (mm)	f'_c = 2000 psi (13.8 MPa)		f'_c = 3000 psi (20.7 MPa)		f'_c = 4000 psi (27.6 MPa)		f'_c = 6000 psi (41.4 MPa)	
		Tension lb (kN)	Shear[2] lb (kN)	Tension lb (kN)	Shear[2] lb (kN)	Tension lb (kN)	Shear[2] lb (kN)	Tension lb (kN)	Shear[2] lb (kN)
1/4 (6.4)	1-1/8 (29)	260 (1.2)	595 (2.6)	320 (1.4)	675 (3.0)	380 (1.7)	725 (3.2)	470 (2.1)	805 (3.6)
	2 (51)	540 (2.4)	675 (3.0)	625 (2.8)		705 (3.1)	805 (3.6)	910 (4.0)	
	3 (76)	685 (3)		750 (3.3)		810 (3.6)			
3/8 (9.5)	1-5/8 (41)	605 (2.7)	880 (3.9)	670 (3.0)	1110 (4.9)	730 (3.2)	1345 (6.0)	950 (4.2)	1690 (7.5)
	2-1/2 (64)	1285 (5.7)	1655[3] (7.4)	1430 (6.4)	1655[3] (7.4)	1575 (7.0)	1870[4] (8.3)	1940 (8.6)	1870[4] (8.3)
	3-1/2 (89)	1620 (7.2)		1755 (7.8)		1885 (8.4)		2035 (9.1)	
1/2 (12.7)	2-1/4 (57)	1015 (4.5)	1875 (8.3)	1230 (5.5)	2130 (9.5)	1450 (6.4)	2380 (10.6)	1620 (7.2)	2740 (12.2)
	3-1/2 (89)	1445 (6.4)	3170[3] (14.1)	1975 (8.8)	3170[3] (14.1)	2510 (11.2)	3580[4] (15.9)	2655 (11.8)	3580[4] (15.9)
	4-3/4 (121)	1990 (8.9)		2250 (10.0)				2985 (13.3)	
5/8 (15.9)	2-3/4 (70)	1650 (7.3)	2875 (12.8)	1755 (7.8)	3485 (15.5)	1860 (8.3)	4095 (18.2)	2335 (10.4)	4870[3] (21.7)
	4 (102)	2455 (10.9)	4870[3] (21.7)	2900 (12.9)	4870[3] (21.7)	3340 (14.9)	4870[3] (21.7)	4395 (19.5)	
	5-1/2 (140)	3480 (15.5)		3885 (17.3)		4290 (19.1)		6260 (27.8)	
3/4 (19.1)	3-1/4 (83)	1550 (6.9)	3945 (17.5)	1950 (8.7)	4260 (18.9)	2350 (10.5)	5645 (25.1)	2610 (11.6)	5645 (25.1)
	4-3/4 (121)	2510 (11.2)	5535 (24.6)	3250 (14.5)	5535 (24.6)	3870 (17.2)		4670 (20.8)	
	8 (203)	2930 (13.0)		3735 (16.6)		4530 (20.2)		5120 (22.8)	
1 (25.4)	4-1/2 (114)	3120 (13.9)	6080 (27.0)	3870 (17.2)	6770 (30.1)	4610 (20.5)	7420 (33.0)	4800 (21.4)	7470 (33.2)
	6 (152)	4400 (19.6)	7470 (33.2)	6400 (28.5)	7470 (33.2)	7200 (32.0)		7330 (32.6)	
	9 (229)	5600 (24.9)		8000 (35.6)		9390 (41.8)		9390 (41.8)	

1 Intermediate load values for other concrete strengths and embedments can be calculated by linear interpolation.

2 Unless otherwise noted, values shown are valid for the shear plane acting through either the anchor body or the anchor threads.

3 Values shown are for a shear plane through the anchor body. When the shear plane is acting through the anchor threads, reduce the shear value by 5%.

4 Values shown are for a shear plane through the anchor body. When the shear plane is acting through the anchor threads, reduce the shear value by 15%.



4.3.5 Kwik Bolt 3 Expansion Anchor

Table 5 - Stainless Steel Kwik Bolt 3 Ultimate Loads in Normal-Weight Concrete[1]

Anchor Diameter in. (mm)	Embedment Depth in. (mm)	f'_c = 2000 psi (13.8 MPa)		f'_c = 3000 psi (20.7 MPa)		f'_c = 4000 psi (27.6 MPa)		f'_c = 6000 psi (41.4 MPa)	
		Tension lb (kN)	Shear[2] lb (kN)	Tension lb (kN)	Shear[2] lb (kN)	Tension lb (kN)	Shear[2] lb (kN)	Tension lb (kN)	Shear[2] lb (kN)
1/4 (6.4)	1-1/8 (29)	980 (4.4)	2240 (10.0)	1205 (5.4)	2530 (11.3)	1430 (6.4)	2725 (12.1)	1755 (7.8)	3020 (13.4)
	2 (51)	2035 (9.1)	2530 (11.3)	2340 (10.4)		2640 (11.7)	3020 (13.4)	3415 (15.2)	
	3 (76)	2580 (11.5)		2810 (12.5)		3040 (13.5)			
3/8 (9.5)	1-5/8 (41)	2275 (10.1)	3300 (14.7)	2505 (11.1)	4175 (18.6)	2735 (12.2)	5045 (22.4)	3560 (15.8)	6330[3] (28.2)
	2-1/2 (64)	4825 (21.5)	6210[3] (27.6)	5365 (23.9)	6210[3] (27.6)	5905 (26.3)	7005[4] (31.2)	7270 (32.3)	7005[4] (31.2)
	3-1/2 (89)	6075 (27.0)		6575 (29.2)		7075 (31.5)		7625 (33.9)	
1/2 (12.7)	2-1/4 (57)	3805 (16.9)	7030 (31.3)	4620 (20.6)	7980 (35.5)	5435 (24.2)	8930 (39.7)	6080 (27.0)	10285 (45.7)
	3-1/2 (89)	5415 (24.1)	11885[3] (52.9)	7410 (33.0)	11885[3] (52.9)	9405 (41.8)	13425[4] (59.7)	9950 (44.3)	13425[4] (59.7)
	4-3/4 (121)	7460 (33.2)		8435 (37.5)				11200 (49.8)	
5/8 (15.9)	2-3/4 (70)	6185 (27.5)	10790 (48.0)	6580 (29.3)	13075 (58.2)	6975 (31.0)	15360 (68.3)	8760 (39.0)	18270[3] (81.3)
	4 (102)	9205 (40.9)	18270[3] (81.3)	10870 (48.4)	18270[3] (81.3)	12530 (55.7)	18270[3] (81.3)	16490 (73.4)	
	5-1/2 (140)	13040 (58.0)		14560 (64.8)		16080 (71.5)		23475 (104.4)	
3/4 (19.1)	3-1/4 (83)	5800 (25.8)	14790 (65.8)	7300 (32.5)	15980 (71.1)	8800 (39.1)	21160 (94.1)	9800 (43.6)	21160 (94.1)
	4-3/4 (121)	9400 (41.8)	20750 (92.3)	11950 (53.2)	20750 (92.3)	14500 (64.5)		17500 (77.8)	
	8 (203)	11000 (48.9)		14000 (62.3)		17000 (75.6)		19200 (85.4)	
1 (25.4)	4-1/2 (114)	11700 (52.0)	22800 (101.4)	14500 (64.5)	25400 (113.0)	17300 (77.0)	28000 (124.6)	18000 (80.1)	28000 (124.6)
	6 (152)	16500 (73.4)	28000 (124.6)	21750 (96.7)	28000 (124.6)	27000 (120.1)		27500 (122.3)	
	9 (229)	21000 (93.4)		28100 (125.0)		35200 (156.6)		35200 (156.6)	

1 Intermediate load values for other concrete strengths and embedments can be calculated by linear interpolation.

2 Unless otherwise noted, values shown are valid for the shear plane acting through either the anchor body or the anchor threads.

3 Values shown are for a shear plane through the anchor body. When the shear plane is acting through the anchor threads, reduce the shear value by 5%.

4 Values shown are for a shear plane through the anchor body. When the shear plane is acting through the anchor threads, reduce the shear value by 15%.

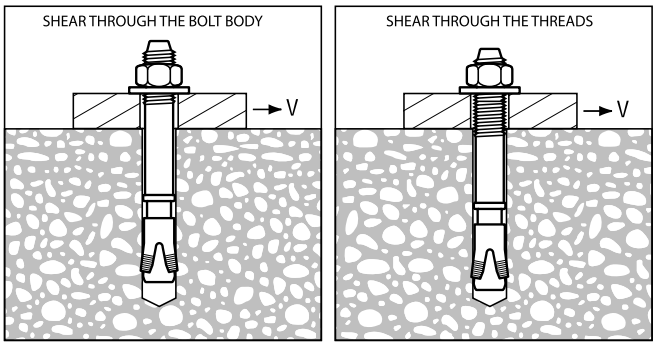


Table 6 - Hot-Dip Galvanized Kwik Bolt 3 Allowable Loads in Normal-Weight Concrete[1, 2]

Anchor Diameter in. (mm)	Embedment Depth in. (mm)	f'_c = 2000 psi (13.8 MPa)		f'_c = 3000 psi (20.7 MPa)		f'_c = 4000 psi (27.6 MPa)		f'_c = 6000 psi (41.4 MPa)	
		Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)
1/2 (12.7)	2-1/4 (57)	1125 (5.0)	1785 (7.9)	1265 (5.6)	1785 (7.9)	1400 (6.2)	2190 (9.7)	1655 (7.4)	2190 (9.7)
	3-1/2 (89)	1895 (8.4)	2190 (9.7)	2115 (9.4)	2190 (9.7)	2335 (10.4)		3105 (13.8)	
	4-3/4 (121)	2215 (9.9)		2530 (11.3)		2845 (12.7)		3740 (16.6)	
5/8 (15.9)	2-3/4 (70)	1785 (7.9)	3780 (16.8)	1965 (8.7)	3780 (16.8)	2140 (9.5)	3780 (16.8)	2745 (12.2)	3790 (16.8)
	4 (102)	2545 (11.3)		3155 (14.0)		3765 (16.7)		5280 (23.5)	
	5-1/2 (140)	3375 (15.0)		4030 (17.9)		4030 (17.9)		6055 (26.9)	
3/4 (19.1)	3-1/4 (83)	2355 (10.5)	4240 (18.9)	2545 (11.3)	4240 (18.9)	2735 (12.2)	5340 (23.8)	2825 (12.6)	5340 (23.8)
	4-3/4 (121)	3730 (16.6)	5340 (23.8)	4350 (19.3)	5340 (23.8)	4970 (22.1)		5805 (25.8)	
	6-1/2 (165)	5115 (22.8)		5805 (25.8)		6495 (28.9)		7520 (33.5)	

1 Intermediate load values for other concrete strengths and embedments can be calculated by linear interpolation.

2 Values shown are for shear plane acting through anchor threads.

Table 7 - Hot-Dip Galvanized Kwik Bolt 3 Ultimate Loads in Normal-Weight Concrete[1, 2]

Anchor Diameter in. (mm)	Embedment Depth in. (mm)	f'_c = 2000 psi (13.8 MPa)		f'_c = 3000 psi (20.7 MPa)		f'_c = 4000 psi (27.6 MPa)		f'_c = 6000 psi (41.4 MPa)	
		Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)
1/2 (12.7)	2-1/4 (57)	4220 (18.8)	6695 (29.8)	4740 (21.1)	6695 (29.8)	5255 (23.4)	8210 (36.5)	6210 (27.6)	8210 (36.5)
	3-1/2 (89)	7100 (31.6)	8210 (36.5)	7935 (35.3)	8210 (36.5)	8765 (39.0)		11645 (51.8)	
	4-3/4 (121)	8310 (37.0)		9495 (42.2)		10675 (47.5)		14030 (62.4)	
5/8 (15.9)	2-3/4 (70)	6690 (29.8)	14170 (63.0)	7360 (32.7)	14170 (63.0)	8030 (35.7)	14170 (63.0)	10295 (45.8)	14170 (63.0)
	4 (102)	9550 (42.5)		11835 (52.6)		14120 (62.8)		19800 (88.1)	
	5-1/2 (140)	12650 (56.3)		15115 (67.2)		17575 (78.2)		22705 (101.0)	
3/4 (19.1)	3-1/4 (83)	8825 (39.3)	15900 (70.7)	9545 (42.5)	15900 (70.7)	10260 (45.6)	20030 (89.1)	10600 (47.2)	20030 (89.1)
	4-3/4 (121)	13995 (62.3)	20030 (89.1)	16315 (72.6)	20030 (89.1)	18635 (82.9)		21765 (96.8)	
	6-1/2 (165)	19180 (85.3)		21770 (96.8)		24355 (108.3)		28210 (125.5)	

1 Intermediate load values for other concrete strengths and embedments can be calculated by linear interpolation.

2 Values shown are for shear plane acting through anchor threads.

4.3.5 Kwik Bolt 3 Expansion Anchor

Table 8 - Carbon Steel Kwik Bolt 3 Allowable Loads in Lightweight Concrete[1, 3]

Anchor Diameter in. (mm)	Anchor Depth in. (mm)	Tension f'_c = 2000 psi (13.8 MPa) lb (kN)	Tension f'_c = 3000 psi (20.7 MPa) lb (kN)	Tension f'_c = 4000 psi (27.6 MPa) lb (kN)	Shear[2] f'_c = 2000 psi (13.8 MPa) lb (kN)
1/4 (6.4)	1-1/8 (29)	275 (1.2)	335 (1.5)	400 (1.8)	400 (1.8)
	2 (51)	595 (2.6)	675 (3.0)	750 (3.3)	400 (1.8)
3/8 (9.5)	1-5/8 (41)	585 (2.6)	685 (3.0)	785 (3.5)	890 (4.0)
	2-1/2 (64)	1120 (5.0)	1340 (6.0)	1560 (6.9)	1345 (5.9)
1/2 (12.7)	2-1/4 (57)	1160 (5.2)	1340 (6.0)	1520 (6.8)	1750 (7.8)
	3-1/2 (89)	1810 (8.1)	2050 (9.1)	2285 (10.2)	2835 (12.6)
5/8 (15.9)	2-3/4 (70)	1560 (6.9)	1815 (8.1)	2070 (9.2)	2580 (11.5)
	4 (102)	2485 (11.1)	2830 (12.6)	3170 (14.1)	3360 (14.9)
3/4 (19.1)	3-1/4 (83)	1920 (8.5)	2240 (10.0)	2560 (11.4)	3835 (17.1)
	4-3/4 (121)	3035 (13.5)	3995 (17.8)	4955 (22)	5010 (22.3)

1 Allowable loads based on safety factor of 4.0.

2 Values shown are for shear plane acting through anchor threads.

3 Intermediate load values for other concrete strengths and embedments can be calculated by linear interpolation.

Table 9 - Stainless Steel Kwik Bolt 3 Allowable Loads in Lightweight Concrete[1, 3]

Anchor Diameter in. (mm)	Anchor Depth in. (mm)	Tension f'_c = 2000 psi (13.8 MPa) lb (kN)	Tension f'_c = 3000 psi (20.7 MPa) lb (kN)	Tension f'_c = 4000 psi (27.6 MPa) lb (kN)	Shear[2] f'_c = 2000 psi (13.8 MPa) lb (kN)
1/4 (6.4)	1-1/8 (29)	245 (1.1)	300 (1.3)	355 (1.6)	545 (2.4)
	2 (51)	510 (2.3)	585 (2.6)	660 (2.9)	630 (2.8)
3/8 (9.5)	1-5/8 (41)	560 (2.5)	625 (2.8)	685 (3.0)	825 (3.7)
	2-1/2 (64)	920 (4.1)	1200 (5.3)	1475 (6.6)	1345 (6.0)
1/2 (12.7)	2-1/4 (57)	950 (4.2)	1155 (5.1)	1360 (6.0)	1755 (7.8)
	3-1/2 (89)	1355 (6.0)	1855 (8.3)	2350 (10.5)	2955 (13.1)
5/8 (15.9)	2-3/4 (70)	1470 (6.5)	1605 (7.1)	1745 (7.8)	2695 (12.0)
	4 (102)	2300 (10.2)	2715 (12.1)	3130 (13.9)	4500 (20.0)

1 Allowable loads based on safety factor of 4.0.

2 Values shown are for shear plane acting through anchor threads.

3 Intermediate load values for other concrete strengths and embedments can be calculated by linear interpolation.

Table 10 - Carbon Steel Kwik Bolt 3 Allowable Loads for anchor installed at 1-3/4 in. Edge Distance in Normal-Weight Concrete[1]

Anchor Diameter in. (mm)	Min Depth Enbedment in. (mm)	$f'_c \geq$ 2000 psi (13.8 MPa)		
		Tension lb (kN)	Shear	
			Perpendicular to Edge lb (kN)	Parallel to Edge lb (kN)
3/8 (9.5)	3 (76)	955 (4.2)	410 (1.8)	915 (4.1)
1/2 (12.7)	3 (76)	930 (4.1)	375 (1.7)	1000 (4.4)
	4-1/2 (114)	1285 (5.7)	445 (2.0)	1415 (6.3)

1 Allowable loads based on safety factor of 4.0.

Table 11 - Carbon Steel and Stainless Steel Kwik Bolt 3 Installed into the Underside of Metal Profile Deck into Lightweight Concrete[1]

Anchor Material	Anchor Diameter in. (mm)	Embedment Depth in. (mm)	f'_c = 3000 psi (20.7 MPa)	
			Tension lb (kN)	Shear lb (kN)
Carbon Steel	1/4 (6.4)	2 (51)	620 (2.8)	713 (3.2)
	3/8 (9.5)	2-1/2 (64)	1035 (4.6)	1370 (6.1)
	1/2 (12.7)	3-1/2 (89)	1725 (7.7)	2435 (10.8)
	5/8 (15.9)	4 (102)	2220 (9.9)	3160 (14.1)
Stainless Steel	1/4 (6.4)	2 (51)	615 (2.7)	650 (2.9)
	3/8 (9.5)	2-1/2 (64)	1015 (4.5)	1450 (6.4)
	1/2 (12.7)	3-1/2 (89)	1475 (6.6)	2200 (9.8)
	5/8 (15.9)	4 (102)	2220 (9.8)	3355 (14.9)

1 Allowable loads based on using a safety factor of 4.0.

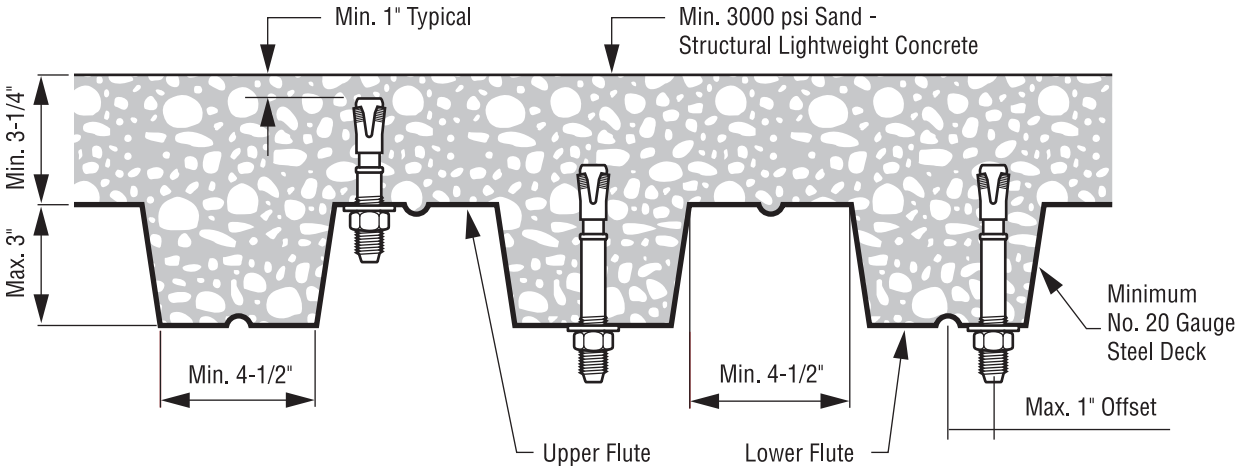


Table 12 - Countersunk Kwik Bolt Allowable Loads in Normal-Weight Concrete[1, 2]

Anchor Material	Anchor Diameter in. (mm)	Embedment Depth in. (mm)	f'_c = 3000 psi (20.7 MPa)	
			Tension lb (kN)	Shear[3] lb (kN)
Carbon Steel	1/4 (6.4)	1-1/8 (29)	365 (1.6)	350 (1.6)
	3/8 (9.5)	1-5/8 (41)	810 (3.6)	750 (3.3)
Stainless Steel	1/4 (6.4)	1-1/8 (29)	320 (1.4)	500 (2.2)
	3/8 (9.5)	1-5/8 (41)	670 (3.0)	1330 (5.9)

1 Allowable loads based on using a safety factor of 4.0.

2 Countersunk Kwik Bolt supported by ICC ESR-1355.

3 Shear values acting thru threads of anchor bolt. If acting through the empty shell, reduce loads by 70%.

Power-Bolt® *Heavy-Duty Sleeve Anchor*

PRODUCT DESCRIPTION

The Power-Bolt anchor, formerly known as the *Rawl-Bolt,* is a heavy duty sleeve style, self-locking anchor which is vibration resistant and removable. It is available with a finished hex head or flat head with a hex key insert and can be used in concrete, block, brick, or stone.

Expansion occurs at two locations within the drilled hole. First, the cone is pulled into the large triple-tined expansion sleeve, developing a mid-level, compression force. Further turning causes the threaded bolt to advance into the threads of the expander cone, forcing its four sections outward. This action undercuts the base material deep in the anchor hole, greatly increasing the holding power of the Power-Bolt. The bolt and cone remain locked together which prevents loosening under even the most severe vibratory conditions.

The Power-Bolt is also designed to draw the fixture into full bearing against the base material through the action of its flexible compression ring. As the anchor is being tightened, the compression ring will crush if necessary to tightly secure the fixture against the face of the base material.

The internal bolt of the Power-Bolt is removable and reusable in the same anchor hole making it ideal for applications such as mounting machinery which may need to be removed for service and for temporary applications such as heavy duty form work.

GENERAL APPLICATIONS AND USES

- Seismic Bracing and Vibratory Applications
- Column Base Plates and Mechanical Equipment
- Dock Bumpers and Support Ledgers
- Racking and Railing Attachments
- Overhead and Critical Anchoring

FEATURES AND BENEFITS

- High load capacity
- Tested in accordance with ASTM E488 and AC01 criteria
- Qualified for seismic and wind load applications
- Two-level expansion mechanism
- Suitable for vibratory, fatigue and shock loading
- Internal high strength bolt is removable and reusable
- Compression zone clamps fixture to the base material
- Low profile finished head design
- Fire tested per Ref. WFRA No. F91763

APPROVALS AND LISTINGS

International Code Council, Evaluation Service (ICC-ES) ESR-1532
(formerly listed in ICBO ES ER-5225)
Southern Building Code Conference International (SBCCI) #9943A
City of Los Angeles (COLA) Research Report LARR – 24960
Florida Building Code Approval – FL2209.4
Miami-Dade County Notice of Acceptance (NOA) 03-0303.14
Factory Mutual Research Corporation (FM Approvals) – File No. J.I. 1K8A3.AH
Underwriters Laboratory (UL Listed) – File No. EX1289
Federal GSA Specification – Meets the proof load requirements of FF-S-325C, Group II, Type 3, Class 3 (superseded)
Various North American Departments of Transportation (DOT) – See www.powers.com

GUIDE SPECIFICATIONS

CSI Divisions: *03151-Concrete Anchoring, 04081-Masonry Anchorage* and *05090-Metal Fastenings.* Expansion Anchors shall be Power-Bolt anchors as supplied by Powers Fasteners, Inc., Brewster, NY.

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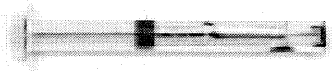


Hex Head Power-Bolt

Flat Head Power-Bolt

HEAD STYLES

Finished Hex Head
Flat Head

ANCHOR MATERIALS

Zinc Plated Carbon Steel
Type 304 Stainless Steel

ANCHOR SIZE RANGE (TYP.)

1/4" diameter x 1" length to
3/4" diameter x 8-1/4" length

SUITABLE BASE MATERIALS

Normal-Weight Concrete
Structural Lightweight Concrete
Grouted Concrete Masonry
Hollow CMU
Brick Masonry
Stone

INSTALLATION SPECIFICATIONS

Carbon Steel Hex Head Power-Bolt

Dimension	Anchor Diameter, *d*					
	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	5/16	3/8	1/2	5/8	3/4
Fixture Clearance Hole, d_h (in.)	5/16	3/8	7/16	9/16	11/16	13/16
Internal Bolt Size (UNC)	10-24	1/4-20	5/16-18	3/8-16	1/2-13	5/8-11
Head Height (in.)	7/64	11/64	13/64	15/64	5/16	25/64
Washer O.D., d_w (in.)	1/2	5/8	13/16	1	1-1/4	1-1/2
Wrench Size (in.)	5/16	7/16	1/2	9/16	3/4	15/16
Max. Tightening Torque, T_{max} (ft-lbs)	3-4	10-12	20-25	35-45	80-100	95-120
Bearing Area (in²)	0.070	0.105	0.145	0.246	0.370	0.515

Carbon Steel Flat Head Power-Bolt (80°–82° head)

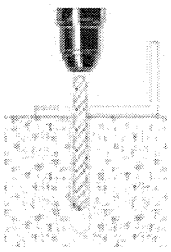
Dimension	Anchor Diameter, *d*		
	3/8"	1/2"	5/8"
ANSI Drill Bit Size, d_{bit} (in.)	3/8	1/2	5/8
Fixture Clearance Hole, d_h (in.)	7/16	9/16	11/16
Internal Bolt Size (UNC)	5/16-18	3/8-16	1/2-13
Head Height (in.)	15/64	1/4	21/64
Head Diameter, d_{hd} (in.)	3/4	7/8	1-1/8
Allen Wrench Size (in.)	7/32	5/16	3/8
Max. Tightening Torque, T_{max} (ft-lbs)	20-25	35-45	80-100
Bearing Area (in²)	0.145	0.246	0.370

Stainless Steel Hex Head Power-Bolt

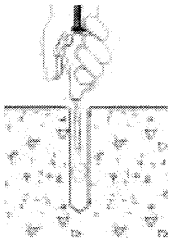
Dimension	Anchor Diameter, *d*				
	1/4"	3/8"	1/2"	5/8"	3/4"
ANSI Drill Bit Size, d_{bit} (in.)	1/4	3/8	1/2	5/8	3/4
Fixture Clearance Hole, d_h (in.)	5/16	7/16	9/16	11/16	13/16
Internal Bolt Size (UNC)	10-24	5/16-18	3/8-16	1/2-13	5/8-11
Head Height (in.)	7/64	13/64	15/64	5/16	25/64
Washer O.D., d_w (in.)	1/2	13/16	1	1-1/4	1-1/2
Wrench Size (in.)	5/16	1/2	9/16	3/4	15/16
Max. Tightening Torque, T_{max} (ft-lbs)	2-3	10-12	20-25	45-60	70-90
Bearing Area (in²)	0.070	0.145	0.246	0.370	0.515

Installation Procedure

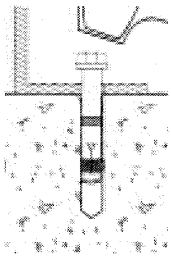
Using the proper diameter bit, drill a hole into the base material to a depth of at least 1/2" or one anchor diameter deeper than the embedment required. The tolerances of the drill bit used should meet the requirements of ANSI Standard B212.15.



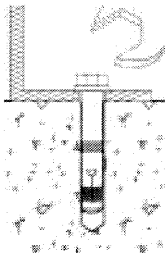
Blow the hole clean of dust and other material. Do not expand the anchor or advance the bolt in the anchor assembly prior to installation.

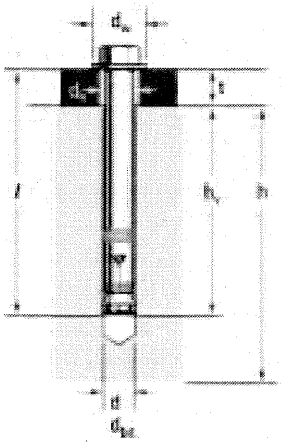


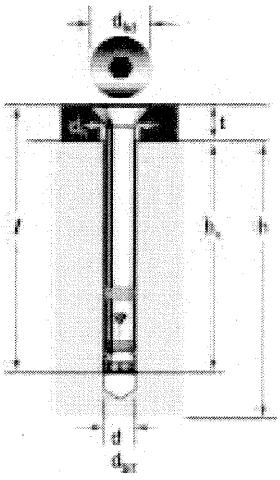
Drive the anchor through the fixture into the anchor hole until the bolt head is firmly seated against the fixture. Be sure the anchor is driven to the required embedment depth.



Tighten the anchor by turning the head 3 to 5 turns past finger tight or by applying the guide installation torque from the finger tight position.







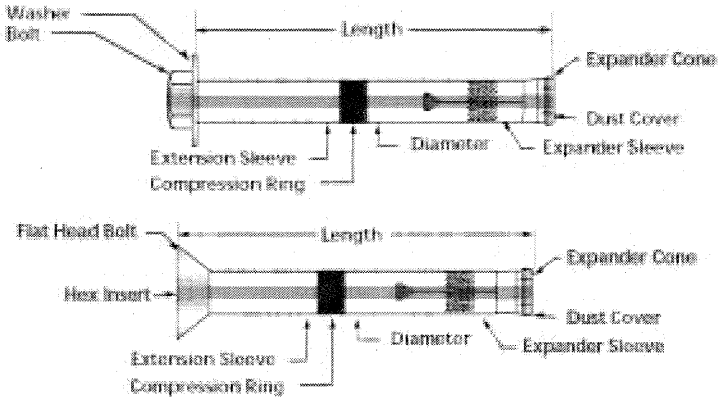
Nomenclature

- d = Diameter of anchor
- d_{bit} = Diameter of drill bit
- d_h = Diameter of fixture clearance hole
- d_{hd} = Flat head diameter
- d_w = Diameter of washer
- h = Base material thickness. The minimum value of h should be $1.5h_v$
- h_v = Minimum embedment depth
- l = Overall length of anchor
- t = Fixture thickness
- T_{max} = Maximum tightening torque

MATERIAL SPECIFICATIONS

Anchor Component	Carbon Steel Hex Head	Carbon Steel Flat Head	Stainless Steel Hex Head
Internal Bolt	*SAE Grade 5	SAE Grade 5	**Type 304 SS
Washer	AISI 1040	N/A	Type 18-8 SS
Expander Sleeve	AISI 1010	AISI 1010	Type 304 SS
Extension Sleeve	AISI 1010	AISI 1010	Type 304 SS
Expander Cone	AISI 12L14	AISI 12L14	Type 303 SS
Compression Ring	Nylon	Nylon	Nylon
Dust Cap	Nylon	Nylon	Nylon
Plating	ASTM B 633, SC1, Type III (Fe/Zn 5) – Zinc		N/A

*1/4" and 5/16" Power-Bolts are manufactured with SAE Grade 8 internal bolts.
**Manufactured with a minimum yield strength of 65,000 psi.
Stainless steel anchor components are passivated.



Length Identification

Mark	♦	■	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
From	1/2"	1"	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	4-1/2"	5"	5-1/2"	6"	6-1/2"	7"	7-1/2"	8"	8-1/2"	9"
Up to but not including	1"	1-1/2"	2"	2-1/2"	3"	3-1/2"	4"	4-1/2"	5"	5-1/2"	6"	6-1/2"	7"	7-1/2"	8"	8-1/2"	9"	9-1/2"

PERFORMANCE DATA

Ultimate Load Capacities for Carbon and Stainless Steel Power-Bolt in Normal-Weight Concrete[1,2]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
		2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	1,180 (5.3)	2,070 (9.3)	1,380 (6.2)	2,100 (9.5)	1,580 (7.1)	2,130 (9.6)	1,660 (7.5)	2,130 (9.6)
	1 3/4 (44.5)	1,400 (6.3)	2,070 (9.3)	1,550 (7.0)	2,305 (10.4)	1,700 (7.7)	2,540 (11.4)	1,860 (8.4)	2,540 (11.4)
	2 1/2 (63.5)	1,880 (8.5)	2,070 (9.3)	1,940 (8.7)	2,730 (12.3)	2,000 (9.0)	3,385 (15.2)	2,100 (9.5)	3,385 (15.2)
5/16 (7.9)	1 1/2 (38.1)	2,320 (10.4)	2,800 (12.6)	2,430 (10.9)	3,000 (13.5)	2,540 (11.4)	3,200 (14.4)	2,620 (11.8)	3,200 (14.4)
	2 (50.8)	2,640 (11.9)	3,280 (14.8)	2,880 (13.0)	3,755 (16.9)	3,120 (14.0)	4,230 (19.0)	3,270 (14.7)	4,230 (19.0)
	3 (76.2)	2,880 (13.0)	3,440 (15.5)	3,330 (15.0)	4,410 (19.8)	3,780 (17.0)	5,380 (24.2)	4,260 (19.2)	5,380 (24.2)
3/8 (9.5)	2 (50.8)	3,500 (15.8)	3,985 (17.9)	4,045 (18.2)	5,205 (23.4)	4,585 (20.6)	6,425 (28.9)	5,915 (26.6)	7,440 (33.5)
	2 1/2 (63.5)	3,800 (17.1)	4,380 (19.7)	4,330 (19.5)	5,770 (26.0)	4,855 (21.8)	7,160 (32.2)	6,665 (30.0)	7,960 (35.8)
	3 1/2 (88.9)	4,395 (19.8)	4,980 (22.4)	5,195 (23.4)	6,815 (30.7)	5,995 (27.0)	8,650 (38.9)	7,150 (32.2)	8,650 (38.9)
1/2 (12.7)	2 1/2 (63.5)	4,900 (22.1)	6,840 (30.8)	5,710 (25.7)	7,535 (33.9)	6,520 (29.3)	8,225 (37.0)	7,320 (32.9)	8,225 (37.0)
	3 1/2 (88.9)	6,140 (27.6)	8,540 (38.4)	7,590 (34.2)	9,200 (41.4)	9,040 (40.7)	9,860 (44.4)	9,890 (44.5)	10,780 (48.5)
	5 (127.0)	7,260 (32.7)	10,140 (45.6)	8,480 (38.2)	11,230 (50.5)	9,700 (43.7)	12,320 (55.4)	10,935 (49.2)	12,315 (55.4)
5/8 (15.9)	2 3/4 (69.9)	5,360 (24.1)	7,970 (35.9)	6,535 (29.4)	9,970 (44.9)	7,705 (34.7)	11,970 (53.9)	8,490 (38.2)	11,970 (53.9)
	4 (101.6)	6,460 (29.1)	10,860 (48.9)	8,210 (36.9)	12,710 (57.2)	9,960 (44.8)	14,560 (65.5)	13,110 (59.0)	15,900 (71.6)
	6 (152.4)	9,400 (42.3)	13,780 (62.0)	10,570 (47.6)	16,230 (73.0)	11,740 (52.8)	18,680 (84.1)	15,580 (70.1)	18,670 (84.0)
3/4 (19.1)	3 (76.2)	7,660 (34.5)	12,375 (55.7)	8,580 (38.6)	14,245 (64.1)	9,500 (42.8)	16,110 (72.5)	10,780 (48.5)	16,110 (72.5)
	4 1/2 (114.3)	10,060 (45.3)	16,900 (76.1)	11,200 (50.4)	20,250 (91.1)	12,340 (55.5)	23,600 (106.2)	16,240 (73.1)	23,600 (106.2)
	7 (177.8)	11,780 (53.0)	22,640 (101.9)	13,440 (60.5)	25,880 (116.5)	15,100 (68.0)	29,120 (131.0)	21,980 (98.9)	29,120 (131.0)

1. The values listed above are ultimate load capacities which should be reduced by a minimum safety factor of 4.0 or greater to determine the allowable working load.
2. Linear interpolation may be used to determine ultimate loads for intermediate embedments and compressive strengths.

PERFORMANCE DATA

Allowable Load Capacities for Carbon and Stainless Steel Power-Bolt in Normal-Weight Concrete[1,2,3]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Minimum Concrete Compressive Strength (f'_c)							
		2,000 psi (13.8 MPa)		**3,000 psi** (20.7 MPa)		**4,000 psi** (27.6 MPa)		**6,000 psi** (41.4 MPa)	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	295 (1.3)	515 (2.3)	345 (1.6)	525 (2.4)	395 (1.8)	535 (2.4)	415 (1.9)	530 (2.4)
	1 3/4 (44.5)	350 (1.6)	515 (2.3)	390 (1.8)	575 (2.6)	425 (1.9)	635 (2.9)	465 (2.1)	635 (2.9)
	2 1/2 (63.5)	470 (2.1)	515 (2.3)	485 (2.2)	680 (3.1)	500 (2.3)	845 (3.8)	525 (2.4)	845 (3.8)
5/16 (7.9)	1 1/2 (38.1)	580 (2.6)	700 (3.2)	610 (2.7)	750 (3.4)	635 (2.9)	800 (3.6)	655 (2.9)	800 (3.6)
	2 (50.8)	660 (3.0)	820 (3.7)	720 (3.2)	940 (4.2)	780 (3.5)	1,060 (4.8)	820 (3.7)	1,060 (4.8)
	3 (76.2)	720 (3.2)	860 (3.9)	835 (3.8)	1,105 (5.0)	945 (4.3)	1,345 (6.1)	1,065 (4.8)	1,345 (6.1)
3/8 (9.5)	2 (50.8)	875 (3.9)	995 (4.5)	1,010 (4.5)	1,300 (5.9)	1,145 (5.2)	1,605 (7.2)	1,480 (6.7)	1,860 (8.4)
	2 1/2 (63.5)	950 (4.3)	1,095 (4.9)	1,080 (4.9)	1,445 (6.5)	1,215 (5.5)	1,790 (8.1)	1,665 (7.5)	1,990 (9.0)
	3 1/2 (88.9)	1,100 (5.0)	1,245 (5.6)	1,300 (5.9)	1,705 (7.7)	1,500 (6.8)	2,165 (9.7)	1,790 (8.1)	2,165 (9.7)
1/2 (12.7)	2 1/2 (63.5)	1,225 (5.5)	1,710 (7.7)	1,430 (6.4)	1,885 (8.5)	1,630 (7.3)	2,055 (9.2)	1,830 (8.2)	2,055 (9.2)
	3 1/2 (88.9)	1,535 (6.9)	2,135 (9.6)	1,900 (8.6)	2,300 (10.4)	2,260 (10.2)	2,465 (11.1)	2,470 (11.1)	2,695 (12.1)
	5 (127.0)	1,815 (8.2)	2,535 (11.4)	2,120 (9.5)	2,810 (12.6)	2,425 (10.9)	3,080 (13.9)	2,735 (12.3)	3,080 (13.9)
5/8 (15.9)	2 3/4 (69.9)	1,340 (6.0)	1,995 (9.0)	1,635 (7.4)	2,495 (11.2)	1,925 (8.7)	2,995 (13.5)	2,125 (9.6)	2,995 (13.5)
	4 (101.6)	1,615 (7.3)	2,715 (12.2)	2,055 (9.2)	3,180 (14.3)	2,490 (11.2)	3,640 (16.4)	3,275 (14.7)	3,975 (17.9)
	6 (152.4)	2,350 (10.6)	3,445 (15.5)	2,645 (11.9)	4,060 (18.3)	2,935 (13.2)	4,670 (21.0)	3,895 (17.5)	4,670 (21.0)
3/4 (19.1)	3 (76.2)	1,915 (8.6)	3,095 (13.9)	2,145 (9.7)	3,560 (16.0)	2,375 (10.7)	4,025 (18.1)	2,695 (12.1)	4,025 (18.1)
	4 1/2 (114.3)	2,515 (11.3)	4,225 (19.0)	2,800 (12.6)	5,065 (22.8)	3,085 (13.9)	5,900 (26.6)	4,060 (18.3)	5,900 (26.6)
	7 (177.8)	2,945 (13.3)	5,660 (25.5)	3,360 (15.1)	6,470 (29.1)	3,775 (17.0)	7,280 (32.8)	5,495 (24.7)	7,280 (32.8)

1. Allowable load capacities listed are calculated using an applied safety factor of 4.0.
2. Linear interpolation may be used to determine allowable loads for intermediate embedments and compressive strengths.
3. Allowable loads for anchors to resist short-term loads such as earthquake or wind may be increased by 33-1/3 percent for the duration of the load, where permitted by code.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Carbon and Stainless Steel Power-Bolt in Structural Lightweight Concrete[1,2,3]

Anchor Diameter	Minimum Embedment Depth	Minimum Concrete Compressive Strength (f'_c)							
		f'_c = 3,000 psi (20.7 MPa)				$f'_c \geq$ 5,000 psi (34.5 MPa)			
		Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
d in. (mm)	h_v in. (mm)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	1,000 (4.5)	1,520 (6.8)	250 (1.1)	380 (1.7)	1,320 (5.9)	1,520 (6.8)	330 (1.5)	380 (1.7)
	2 (50.8)	1,510 (6.8)	1,540 (6.9)	380 (1.7)	385 (1.7)	–	–	–	–
3/8 (9.5)	2 (50.8)	2,160 (9.7)	2,780 (12.5)	540 (2.4)	695 (3.1)	3,240 (14.6)	2,780 (12.5)	810 (3.6)	695 (3.1)
	3 1/2 (88.9)	4,200 (18.9)	4,980 (22.4)	1,050 (4.7)	1,245 (5.6)	–	–	–	–
1/2 (12.7)	2 1/2 (63.5)	3,680 (16.6)	4,615 (20.8)	920 (4.1)	1,155 (5.2)	4,920 (22.1)	4,615 (20.8)	1,230 (5.5)	1,155 (5.2)
	5 (127.0)	5,540 (24.9)	8,730 (39.3)	1,385 (6.2)	2,185 (9.8)	–	–	–	–
5/8 (15.9)	2 3/4 (69.9)	3,120 (14.0)	6,840 (30.8)	780 (3.5)	1,710 (7.7)	5,240 (23.6)	6,840 (30.8)	1,310 (5.9)	1,710 (7.7)
	6 (152.4)	6,730 (30.3)	14,340 (64.5)	1,685 (7.6)	3,585 (16.1)	–	–	–	–
3/4 (19.1)	3 (76.2)	5,600 (25.2)	8,765 (39.4)	1,400 (6.3)	2,190 (9.9)	7,880 (35.5)	8,765 (39.4)	1,970 (8.9)	2,190 (9.9)
	7 (177.8)	9,860 (44.4)	19,740 (88.8)	2,465 (11.1)	4,935 (22.2)	–	–	–	–

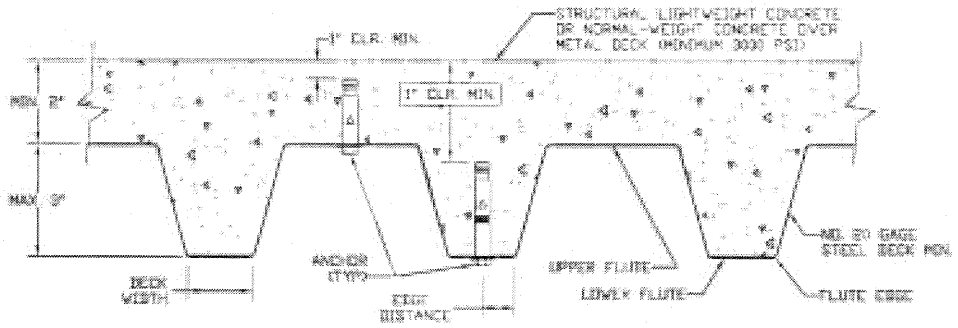
1. The values listed above are ultimate and allowable load capacities for Power-Bolt anchors in sand-lightweight concrete.
2. Allowable load capacities are calculated using an applied safety factor of 4.0.
3. Linear interpolation may be used to determine ultimate and allowable loads for intermediate embedments and compressive strengths.

PERFORMANCE DATA

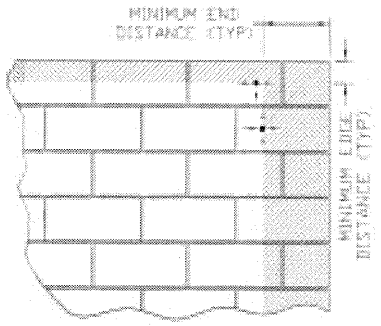
Ultimate and Allowable Load Capacities for Carbon and Stainless Steel Power-Bolt Installed Through Metal Deck into Structural Lightweight Concrete[1,2,3,4]

Anchor Diameter d in. (mm)	Minimum Embedment Depth h_v in. (mm)	Lightweight Concrete over minimum 20 Gage Metal Deck, $f'_c \geq$ 3,000 (20.7 MPa)							
		Minimum 1-1/2" Wide Deck				Minimum 4-1/2" Wide Deck			
		Ultimate Load		Allowable Load		Ultimate Load		Allowable Load	
		Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/4 (31.8)	720 (3.2)	2,360 (10.6)	180 (0.8)	590 (2.7)	920 (4.1)	2,360 (10.6)	230 (1.0)	590 (2.7)
3/8 (9.5)	2 (50.8)	720 (3.2)	2,740 (12.3)	180 (0.8)	685 (3.1)	1,840 (8.3)	2,740 (12.3)	460 (2.1)	685 (3.1)
1/2 (12.7)	2 1/2 (63.5)	1,640 (7.4)	2,740 (12.3)	410 (1.8)	685 (3.1)	2,000 (9.0)	4,400 (19.8)	500 (2.3)	1,100 (5.0)
5/8 (15.9)	2 3/4 (88.9)	–	–	–	–	2,000 (9.0)	4,440 (20.0)	500 (2.3)	1,110 (5.0)
3/4 (19.1)	3 (76.2)	–	–	–	–	4,960 (22.3)	4,480 (20.2)	1,240 (5.6)	1,120 (5.0)

1. The values listed above are ultimate and allowable load capacities for Power-Bolt anchor in sand-lightweight concrete over metal deck.
2. Allowable loads capacities are calculated using an applied safety factor of 4.0.
3. Tabulated load values are for anchors installed in the center of the flute. Spacing distances shall be in accordance with the spacing table for lightweight concrete listed in the Design Criteria section for Power-Bolt.
4. Anchors are permitted to be installed in the lower or upper flute of the metal deck provided the proper installation procedures are maintained.



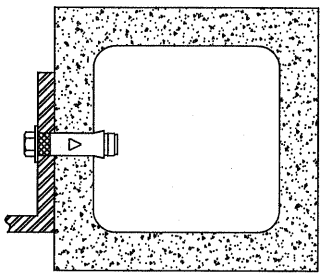
PERFORMANCE DATA



Ultimate and Allowable Load Capacities for Power-Bolt in Grout-Filled Concrete Masonry[1,2,3,4]

Anchor Diameter d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
				Ultimate Load		Allowable Load	
				Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	1 1/8 (28.6)	3 3/4 (95.3)	3 3/4 (95.3)	1,215 (5.5)	1,185 (5.3)	245 (1.1)	235 (1.1)
	2 1/2 (63.5)	5 1/4 (133.4)	3 3/4 (95.3)	1,760 (7.9)	1,185 (5.3)	350 (1.6)	235 (1.1)
3/8 (9.5)	2 (50.8)	5 5/8 (142.9)	5 5/8 (142.9)	1,985 (8.9)	3,065 (13.8)	395 (1.8)	615 (2.8)
	3 1/2 (88.9)	7 7/8 (200.0)	5 5/8 (142.9)	2,120 (9.5)	3,065 (13.8)	425 (1.9)	615 (2.8)
1/2 (12.7)	2 1/2 (63.5)	7 1/2 (190.5)	7 1/2 (190.5)	2,435 (11.0)	5,650 (25.4)	485 (2.2)	1,130 (5.1)
	4 (101.6)	10 1/2 (266.7)	7 1/2 (190.5)	2,690 (12.1)	5,650 (25.4)	540 (2.4)	1,130 (5.1)
5/8 (15.9)	2 3/4 (69.9)	9 3/8 (238.1)	9 3/8 (238.1)	2,560 (11.5)	9,000 (40.5)	510 (2.3)	1,800 (8.1)
	5 (127.0)	13 1/8 (333.4)	9 3/8 (238.1)	2,975 (13.4)	9,000 (40.5)	595 (2.7)	1,800 (8.1)
3/4 (19.1)	3 (76.2)	11 1/4 (285.8)	11 1/4 (285.8)	3,345 (15.0)	9,870 (44.4)	670 (3.0)	1,975 (8.9)
	5 (127.0)	15 3/4 (400.1)	11 1/4 (285.8)	4,250 (19.1)	9,870 (44.4)	850 (3.8)	1,975 (8.9)

1. Tabulated load values are for carbon and stainless steel anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal weight concrete masonry units. Mortar must be minimum Type N. Masonry prism compressive strength must be 1,500 psi minimum at the time of installation.
2. Allowable loads are for carbon and stainless steel anchors and are based on average ultimate values using a safety factor of 5.0.
3. Linear interpolation may be used to determine ultimate and allowable loads for intermediate embedment depths.
4. The tabulated values are for anchors installed at a minimum of 12 anchor diameters on center for 100 percent capacity. Spacing distances may be reduced to 6 anchor diameters on center provided the capacities are reduced by 50 percent. Linear interpolation may be used for intermediate spacing.



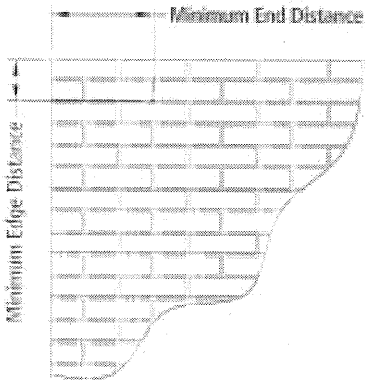
Ultimate and Allowable Load Capacities for Power-Bolt in Hollow Concrete Masonry[1,2,3,4,5]

Anchor Diameter d in. (mm)	Minimum Embed. Depth h_v in. (mm)	Minimum Edge Distance in. (mm)	Minimum End Distance in. (mm)	$f'_m \geq$ 1,500 psi (10.4 MPa)			
				Ultimate Load		Allowable Load	
				Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	7/8 (22.2)	3 3/4 (95.3)	3 3/4 (95.3)	600 (2.7)	765 (3.4)	120 (0.5)	155 (0.7)
	1 1/4 (31.8)	3 3/4 (95.3)	8 (203.2)	825 (3.7)	1,055 (4.8)	165 (0.7)	210 (0.9)
	1 1/2 (38.1)	3 3/4 (95.3)	12 (304.8)	1,130 (5.1)	1,230 (5.5)	225 (1.0)	245 (1.1)
3/8 (9.5)	1 1/4 (31.8)	12 (304.8)	8 (203.2)	1,360 (6.1)	2,150 (9.7)	270 (1.2)	430 (1.9)
	1 1/2 (38.1)	12 (304.8)	12 (304.8)	1,470 (6.6)	2,600 (11.7)	295 (1.3)	520 (2.3)
1/2 (12.7)	1 1/4 (31.8)	12 (304.8)	8 (203.2)	2,560 (11.5)	2,150 (9.7)	590 (2.4)	430 (1.9)
	1 1/2 (38.1)	12 (304.8)	12 (304.8)	2,560 (11.5)	3,385 (15.2)	510 (2.3)	675 (3.0)

1. Tabulated load values are for carbon and stainless steel anchors installed in minimum 6-inch wide, Grade N, Type II, medium and normal weight concrete masonry units. Mortar must be minimum Type N. Masonry prism compressive strength must be 1,500 psi minimum at the time of installation.
2. Allowable loads are for carbon and stainless steel anchors and are based on average ultimate values using a safety factor of 5.0.
3. Linear interpolation may be used to determine ultimate and allowable loads for intermediate embedment depths.
4. The tabulated values are for anchors installed at a minimum of 12 anchor diameters on center for 100 percent capacity. Spacing distances may be reduced to 6 anchor diameters on center provided the capacities are reduced by 50 percent. Linear interpolation may be used for intermediate spacing.
5. Anchors with diameters of 1/2" and larger installed in hollow concrete masonry units are limited to one anchor per unit cell.

PERFORMANCE DATA

Ultimate and Allowable Load Capacities for Power-Bolt in Clay Brick Masonry[1,2,3]



Anchor Dia. d in. (mm)	Min. Embed. Depth h_v in. (mm)	Min. Edge Distance	Min. End Distance	Spacing Distance	Structural Brick Masonry $f'_m \geq$ 1,500 psi (10.4 MPa)			
					Ultimate Load		Allowable Load	
					Tension lbs. (kN)	Shear lbs. (kN)	Tension lbs. (kN)	Shear lbs. (kN)
1/4 (6.4)	7/8 (22.2)	8 (203.2)	4 (101.6)	6 (152.4)	1,090 (4.9)	1,160 (5.2)	220 (1.0)	230 (1.0)
	1 1/2 (38.1)				1,455 (6.6)	1,265 (5.7)	290 (1.3)	255 (1.1)
3/8 (9.5)	2 (50.8)	12 (304.8)	6 (152.4)	8 (203.2)	2,015 (9.1)	3,655 (16.5)	405 (1.8)	730 (3.3)
1/2 (12.7)	2 1/2 (63.5)		8 (203.2)	10 (254.0)	3,110 (14.0)	4,585 (20.6)	620 (2.8)	915 (4.1)
5/8 (15.9)	2 3/4 (69.9)	16 (406.4)	10 (254.0)	12 (304.8)	4,535 (20.4)	5,470 (24.6)	905 (4.1)	1,095 (4.9)
3/4 (19.1)	3 (76.2)		12 (304.8)	16 (406.4)	5,930 (26.7)	6,770 (30.5)	1,185 (5.3)	1,355 (6.1)

1. Tabulated load values are for carbon and stainless steel anchors installed in Grade SW multiple wythe, solid brick masonry conforming to ASTM C62.
2. Allowable loads are calculated using an applied safety factor of 5.0.
3. Spacing between anchors may be reduced to half the listed distances provided the capacities are reduced by 50 percent. Linear interpolation may be used for intermediate spacing.

DESIGN CRITERIA

Combined Loading

For anchors loaded in both shear and tension, the combination of loads should be proportioned as follows:

$$\left(\frac{Nu}{Nn}\right)^{\frac{5}{3}} + \left(\frac{Vu}{Vn}\right)^{\frac{5}{3}} \leq 1 \quad \text{OR} \quad \left(\frac{Nu}{Nn}\right) + \left(\frac{Vu}{Vn}\right) \leq 1$$

Where: N_u = Applied Service Tension Load
N_n = Allowable Tension Load
V_u = Applied Service Shear Load
V_n = Allowable Shear Load

Load Adjustment Factors for Spacing and Edge Distances

Anchor Installed in Normal-Weight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 2.0h_v$	$F_N = F_V = 1.0$	$s_{min} = h_v$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{min} = 5d$	$F_N = 0.70$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 5d$	$F_V = 0.35$

Anchor Installed in Lightweight Concrete					
Anchor Dimension	Load Type	Critical Distance (Full Anchor Capacity)	Critical Load Factor	Minimum Distance (Reduced Capacity)	Minimum Load Factor
Spacing (s)	Tension and Shear	$s_{cr} = 2.0h_v$	$F_N = F_V = 1.0$	$s_{min} = h_v$	$F_N = F_V = 0.50$
Edge Distance (c)	Tension	$c_{cr} = 12d$	$F_N = 1.0$	$c_{min} = 5d$	$F_N = 0.80$
	Shear	$c_{cr} = 12d$	$F_V = 1.0$	$c_{min} = 5d$	$F_V = 0.40$

DESIGN CRITERIA

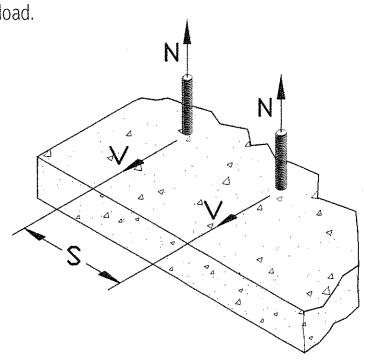
Load Adjustment Factors for Normal-Weight Concrete

Spacing, Tension (F_N) & Shear (F_V)

Dia. (in.)		1/4			3/8			1/2			5/8			3/4		
h_v (in.)		1 1/4	1 3/4	2 1/2	2	2 1/2	3 1/2	2 1/2	3 1/2	5	2 3/4	4	6	3	4 1/2	7
s_{cr} (in.)		2 1/2	3 1/2	5	4	5	7	5	7	10	5 1/2	8	12	6	9	14
s_{min} (in.)		1 1/4	1 3/4	2 1/2	2	2 1/2	3 1/2	2 1/2	3 1/2	5	2 3/4	4	6	3	4 1/2	7
Spacing, s (inches)	1 1/4	0.50														
	1 3/4	0.70	0.50													
	2	0.80	0.57		0.50											
	2 1/2	1.00	0.71	0.50	0.63	0.50		0.50								
	2 3/4		0.79	0.55	0.69	0.55		0.55			0.50					
	3		0.86	0.60	0.75	0.60		0.60			0.55			0.50		
	3 1/2		1.00	0.70	0.88	0.70	0.50	0.70	0.50		0.64			0.58		
	4			0.80	1.00	0.80	0.57	0.80	0.57		0.73	0.50		0.67		
	4 1/2			0.90		0.90	0.64	0.90	0.64		0.82	0.56		0.75	0.50	
	5			1.00		1.00	0.71	1.00	0.71	0.50	0.91	0.63		0.83	0.56	
	5 1/2						0.79		0.79	0.55	1.00	0.69		0.92	0.61	
	6						0.86		0.86	0.60		0.75	0.50	1.00	0.67	
	7						1.00		1.00	0.70		0.88	0.58		0.78	0.50
	8									0.80		1.00	0.67		0.89	0.57
	9									0.90			0.75		1.00	0.64
	10									1.00			0.83			0.71
	12												1.00			0.86
	14															1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 2 embedment depths ($2\,h_v$) at which the anchor achieves 100% of load.

Minimum spacing (s_{min}) is equal to 1 embedment depth (h_v) at which the anchor achieves 50% of load.

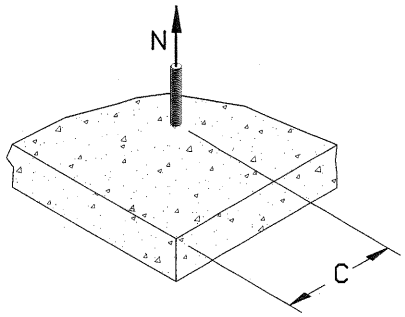


Edge Distance, Tension (F_N)

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	4 1/2	6	7 1/2	9
c_{min} (in.)		1 1/4	1 7/8	2 1/2	3 1/8	3 3/4
Edge Distance, c (inches)	1 1/4	0.70				
	1 5/8	0.76				
	1 7/8	0.81	0.70			
	2	0.83	0.71			
	2 1/2	0.91	0.77	0.70		
	3	1.00	0.83	0.74		
	3 1/8		0.84	0.75	0.70	
	3 3/4		0.91	0.81	0.74	0.70
	4		0.94	0.83	0.76	0.71
	4 1/2		1.00	0.87	0.79	0.74
	5			0.91	0.83	0.77
	6			1.00	0.90	0.83
	6 1/4				0.91	0.84
	7				0.97	0.89
	7 1/2				1.00	0.91
	8					0.94
	9					1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 70% of load.

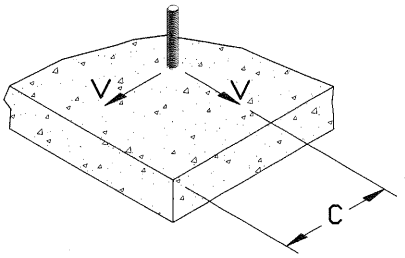


Edge Distance, Shear (F_V)

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	4 1/2	6	7 1/2	9
c_{min} (in.)		1 1/4	1 7/8	2 1/2	3 1/8	3 3/4
Edge Distance, c (inches)	1 1/4	0.35				
	1 5/8	0.49				
	1 7/8	0.58	0.35			
	2	0.63	0.38			
	2 1/2	0.81	0.50	0.35		
	3	1.00	0.63	0.44		
	3 1/8		0.66	0.47	0.35	
	3 3/4		0.81	0.58	0.44	0.35
	4		0.88	0.63	0.48	0.38
	4 1/2		1.00	0.72	0.55	0.44
	5			0.81	0.63	0.50
	6			1.00	0.78	0.63
	6 1/4				0.81	0.66
	7				0.93	0.75
	7 1/2				1.00	0.81
	8					0.88
	9					1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 35% of load.



DESIGN CRITERIA

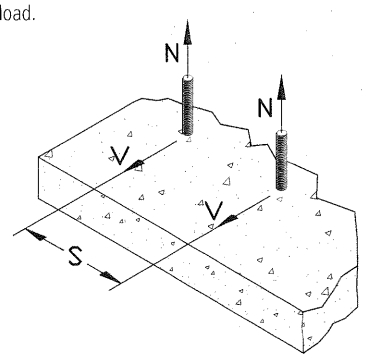
Load Adjustment Factors for Lightweight Concrete

Spacing, Tension (F_N) & Shear (F_V)

Dia. (in.)		1/4			3/8			1/2			5/8			3/4		
h_v (in.)		1 1/4	1 3/4	2 1/2	2	2 1/2	3 1/2	2 1/2	3 1/2	5	2 3/4	4	6	3	4 1/2	7
s_{cr} (in.)		2 1/2	3 1/2	5	4	5	7	5	7	10	5 1/2	8	12	6	9	14
s_{min} (in.)		1 1/4	1 3/4	2 1/2	2	2 1/2	3 1/2	2 1/2	3 1/2	5	2 3/4	4	6	3	4 1/2	7
Spacing, s (inches)	1 1/4	0.50														
	1 3/4	0.70	0.50													
	2	0.80	0.57		0.50											
	2 1/2	1.00	0.71	0.50	0.63	0.50		0.50								
	2 3/4		0.79	0.55	0.69	0.55		0.55			0.50					
	3		0.86	0.60	0.75	0.60		0.60			0.55			0.50		
	3 1/2		1.00	0.70	0.88	0.70	0.50	0.70	0.50		0.64			0.58		
	4			0.80	1.00	0.80	0.57	0.80	0.57		0.73	0.50		0.67		
	4 1/2			0.90		0.90	0.64	0.90	0.64		0.82	0.56		0.75	0.50	
	5			1.00		1.00	0.71	1.00	0.71	0.50	0.91	0.63		0.83	0.56	
	5 1/2						0.79		0.79	0.55	1.00	0.69		0.92	0.61	
	6						0.86		0.86	0.60		0.75	0.50	1.00	0.67	
	7						1.00		1.00	0.70		0.88	0.58		0.78	0.50
	8									0.80		1.00	0.67		0.89	0.57
	9									0.90			0.75		1.00	0.64
	10									1.00			0.83			0.71
	12												1.00			0.86
	14															1.00

Notes: For anchors loaded in tension and shear, the critical spacing (s_{cr}) is equal to 2 embedment depths ($2\ h_v$) at which the anchor achieves 100% of load.

Minimum spacing (s_{min}) is equal to 1 embedment depth (h_v) at which the anchor achieves 50% of load.

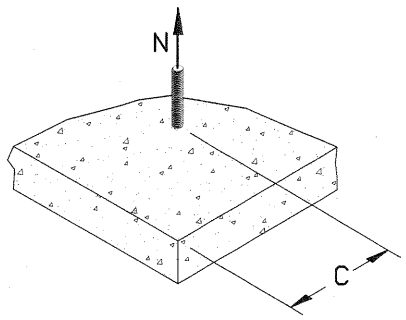


Edge Distance, Tension (F_N)

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	4 1/2	6	7 1/2	9
c_{min} (in.)		1 1/4	1 7/8	2 1/2	3 1/8	3 3/4
Edge Distance, c (inches)	1 1/4	0.80				
	1 5/8	0.84				
	1 7/8	0.87	0.80			
	2	0.89	0.81			
	2 1/2	0.94	0.85	0.80		
	3	1.00	0.89	0.83		
	3 1/8		0.90	0.84	0.80	
	3 3/4		0.94	0.87	0.83	0.80
	4		0.96	0.89	0.84	0.81
	4 1/2		1.00	0.91	0.86	0.83
	5			0.94	0.89	0.85
	6			1.00	0.93	0.89
	6 1/4				0.94	0.90
	7				0.98	0.92
	7 1/2				1.00	0.94
	8					0.96
	9					1.00

Notes: For anchors loaded in tension, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 80% of load.

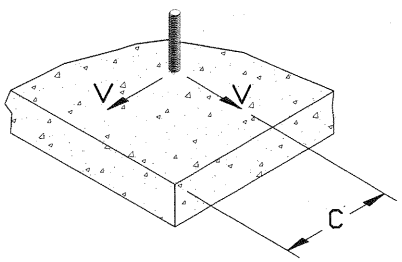


Edge Distance, Shear (F_V)

Dia. (in.)		1/4	3/8	1/2	5/8	3/4
c_{cr} (in.)		3	4 1/2	6	7 1/2	9
c_{min} (in.)		1 1/4	1 7/8	2 1/2	3 1/8	3 3/4
Edge Distance, c (inches)	1 1/4	0.40				
	1 5/8	0.53				
	1 7/8	0.61	0.40			
	2	0.66	0.43			
	2 1/2	0.83	0.54	0.40		
	3	1.00	0.66	0.49		
	3 1/8		0.69	0.51	0.40	
	3 3/4		0.83	0.61	0.49	0.40
	4		0.89	0.66	0.52	0.43
	4 1/2		1.00	0.74	0.59	0.49
	5			0.83	0.66	0.54
	6			1.00	0.79	0.66
	6 1/4				0.83	0.69
	7				0.93	0.77
	7 1/2				1.00	0.83
	8					0.89
	9					1.00

Notes: For anchors loaded in shear, the critical edge distance (c_{cr}) is equal to 12 anchor diameters ($12d$) at which the anchor achieves 100% of load.

Minimum edge distance (c_{min}) is equal to 5 anchor diameters ($5d$) at which the anchor achieves 40% of load.



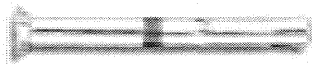
ORDERING INFORMATION

Carbon Steel Hex Head Power-Bolt

Cat. No.	Anchor Size	Drill Dia.	Min. Embed.	Std. Box	Std. Carton	Wt./100
6900	1/4" x 1"	1/4"	7/8"	100	600	2
6902	1/4" x 1 3/4"	1/4"	1-1/4"	100	600	3
6906	1/4" x 3"	1/4"	1-1/4"	100	600	5
6907	5/16" x 1 3/4"	5/16"	1-1/2"	100	600	5
6908	5/16" x 2 1/2"	5/16"	1-1/2"	50	300	6
6909	5/16" x 3 1/2"	5/16"	1-1/2"	50	300	8
6910	3/8" x 2 1/4"	3/8"	2"	50	300	8
6911*	3/8" x 1 7/8"	3/8"	1-1/4"	100	600	6
6913	3/8" x 3"	3/8"	2"	50	300	11
6914	3/8" x 3 1/2"	3/8"	2"	50	300	12
6916	3/8" x 4"	3/8"	2"	50	300	14
6930	1/2" x 2 3/4"	1/2"	2-1/2"	50	200	16
6932	1/2" x 3 3/4"	1/2"	2-1/2"	25	150	21
6934	1/2" x 4 3/4"	1/2"	2-1/2"	25	150	26
6936	1/2" x 5 3/4"	1/2"	2-1/2"	25	150	32
6940	5/8" x 3"	5/8"	2-3/4"	20	120	28
6942	5/8" x 4"	5/8"	2-3/4"	15	90	40
6944	5/8" x 5"	5/8"	2-3/4"	15	90	47
6945	5/8" x 6"	5/8"	2-3/4"	15	90	57
6947	5/8" x 8 1/2"	5/8"	2-3/4"	10	40	77
6950	3/4" x 3 1/4"	3/4"	3"	15	90	47
6952	3/4" x 4 1/4"	3/4"	3"	10	60	58
6954	3/4" x 5 1/4"	3/4"	3"	10	60	70
6956	3/4" x 7 1/4"	3/4"	3"	10	40	105
6957	3/4" x 8 1/4"	3/4"	3"	10	40	110

The published length is measured from below the washer to the end of the anchor.
*This size does not have a compression ring.

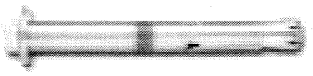
Carbon Steel Flat Head Power-Bolt



Cat. No.	Anchor Size	Drill Dia.	Min. Embed.	Std. Box	Std. Carton	Wt./100
6981	3/8" x 3 3/4"	3/8"	2"	50	300	14
6982	3/8" x 5"	3/8"	2"	50	300	17
6983	3/8" x 6"	3/8"	2"	50	300	20
6984	1/2" x 5"	1/2"	2-1/2"	25	150	26
6987	5/8" x 5 1/2"	5/8"	2-3/4"	15	90	57

The published length is the overall length of the anchor.
The flat head Power-Bolt anchor has a hex key insert formed in the head of the bolt.
Each box contains an Allen wrench which matches the insert size.

Stainless Steel Hex Head Power-Bolt



Cat. No.	Anchor Size	Drill Dia.	Min. Embed.	Std. Box	Std. Carton	Wt./100
5900*	1/4" x 1"	1/4"	7/8"	100	600	2
5902	1/4" x 1 3/4"	1/4"	1-1/4"	100	600	3
5906	1/4" x 3"	1/4"	1-1/4"	100	600	5
5910	3/8" x 2 1/4"	3/8"	2"	50	300	10
5914	3/8" x 3 1/2"	3/8"	2"	50	300	12
5916	3/8" x 4"	3/8"	2"	50	300	14
5930	1/2" x 2 3/4"	1/2"	2-1/2"	50	200	16
5934	1/2" x 4 3/4"	1/2"	2-1/2"	25	150	26
5944	5/8" x 5"	5/8"	2-3/4"	15	90	47
5946	5/8" x 7"	5/8"	2-3/4"	15	60	67
5954	3/4" x 5-1/4"	3/4"	3"	15	60	70
5957	3/4" x 8 1/4"	3/4"	3"	10	40	110

The published length is measured from below the washer to the end of the anchor.
*This size does not have a compression ring.

SECTION IV

VALVES & ALARM DEVICES

300 lb. WWP UL/FM Butterfly Valves

Fire Protection Valve • Grooved Mechanical Style • Nylon Coated Ductile Iron • Extended Neck • Elastomer Encapsulated Disc • Accepts Internal and External Supervisory Switches

300 PSI/20.7 Bar Non-Shock Cold Water 2½" - 8"
175 PSI/12.1 Bar Non-Shock Cold Water 10"

UL/ULC LISTED • FMRC APPROVED • 2½" - 10" UL LISTED FOR INDOOR AND OUTDOOR SERVICE • CALIFORNIA STATE FIRE MARSHALL APPROVAL NO. 7770-1243:101 • APPROVED BY THE NEW YORK CITY MEA 9-97-E, VOL.2 WHEN ASSEMBLED WITH APPROPRIATE NYC INDICATOR FLAG

MATERIAL LIST

PART		SPECIFICATION
1.	Upper Stem	Stainless Steel ASTM A 582 Type 416
2.	Upper Bushing	PTFE Bronze Sintered on Steel
3.	"O" Ring	Buna-N
4.	Body	Ductile Iron ASTM A 395 with Polymide Coating
5.	Disc	Ductile Iron ASTM A 395 with EPDM Encapsulation
6.	Lower Bushing	PTFE Bronze Sintered on Steel
7.	Lower Stem	Stainless Steel ASTM A 582 Type 416
8.	Dust Plug	PVC
9.	Nameplate	Aluminum
10.	Gear Operator	Cast Iron and Steel
11.	Indicator Flag	Cast Iron
12.	Handwheel	Cast Iron

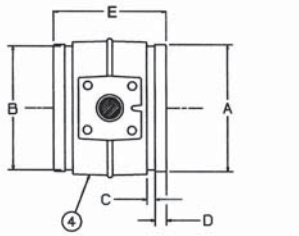
***-8N version has two factory mounted internal supervisory switches.**
-4N version is gear operated only
Uses NIBCO model #TS-4 Switch Kit.
Polymide coating has NSF certification.

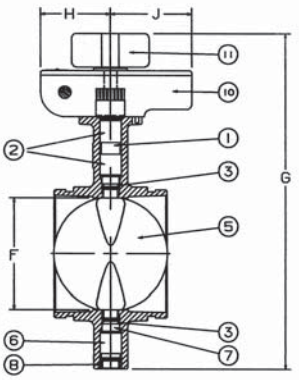
GD-1765-8N
10"
(not shown)

GD-4765-8N*
Grooved
2½" thru 8"

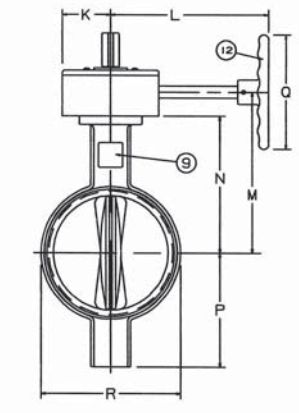
DIMENSIONS—WEIGHTS—QUANTITIES

Size		Dimensions A		B		C		D		E		F		G		H	
In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.
2½	65	2.88	73	2.72	69	0.31	8	0.63	16	3.85	98	2.42	61	11.94	303	2.91	74
3 O.D.	76.1	3.00	76	2.84	72	0.31	8	0.63	16	3.85	98	2.42	61	11.94	303	2.91	74
3	80	3.50	89	3.34	85	0.31	8	0.63	16	3.85	98	2.86	73	12.48	317	2.91	74
4	100	4.50	114	4.33	110	0.38	10	0.63	16	4.56	116	3.84	98	14.18	360	2.91	74
5	125	5.56	141	5.39	137	0.38	10	0.63	16	5.86	149	4.79	122	15.17	385	2.91	74
6	150	6.63	168	6.45	164	0.38	10	0.63	16	5.86	149	5.73	146	17.54	446	2.91	74
6 O.D.	165.1	6.51	165	6.32	161	0.38	10	0.63	16	5.86	149	5.73	146	17.54	446	2.91	74
8	200	8.63	219	8.44	214	0.44	11	0.75	19	5.26	134	7.71	196	19.42	493	2.91	74
10	250	10.75	273	10.56	268	0.50	13	0.75	19	6.29	160	9.56	243	24.03	610	3.90	99





Size		Dimensions J		K		L		M		N		P		Q		R		Weight	
In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.
2½	65	3.54	90	2.13	54	5.82	148	5.67	144	4.19	106	3.25	83	5.9	150	3.46	88	22	10.0
3 O.D.	76.1	3.54	90	2.13	54	5.82	148	5.67	144	4.19	106	3.25	83	5.9	150	3.46	88	22	10.4
3	80	3.54	90	2.13	54	5.82	148	5.94	151	4.44	113	3.54	90	5.9	150	3.97	101	23	10.4
4	100	3.54	90	2.13	54	7.64	194	6.31	173	5.33	135	4.35	110	5.9	150	5.03	128	28	12.7
5	125	3.54	90	2.13	54	7.64	194	7.32	186	5.83	148	4.84	123	5.9	150	6.27	159	31	14.1
6	150	3.54	90	2.13	54	7.64	194	8.62	219	7.11	181	5.93	151	5.9	150	7.25	184	41	18.6
6 O.D.	165.1	3.54	90	2.13	54	7.64	194	8.62	219	7.11	181	5.93	151	5.9	150	7.25	184	41	18.6
8	200	3.54	90	2.13	54	7.91	201	9.80	249	8.05	204	6.87	174	9.8	250	9.25	235	53	24.1
10	250	3.98	101	3.03	77	9.49	241	11.61	295	9.86	250	9.17	233	11.8	300	11.25	286	88	40.0



FM APPROVED
c UL us

NIBCO INC. WORLD HEADQUARTERS • 1516 MIDDLEBURY ST. • ELKHART, IN 46516-4740 • USA • PH: 1.800.234.0227
TECH SERVICES PH: 1.888.446.4226 • FAX: 1.888.336.4226 • INTERNATIONAL OFFICE PH: +1.574.295.3327 • FAX: +1.574.295.3455
www.nibco.com

tyco / Fire & Building Products

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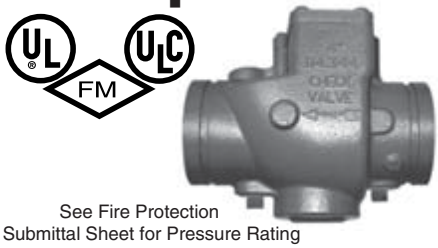
Tyco Fire Products Model CV-1F Check Valve

General Description



See Fire Protection Submittal Sheet for Pressure Rating and Listing/Approval Information

The Model CV-1F Fire Protection Check Valve is furnished with grooved ends and can be installed using grooved couplings. The Model CV-1F can be installed with ANSI class 150 Flanges utilizing Grinnell Figure 71 flange adapters and also ANSI class 300 Flange Adapters. All Model CV-1F Check Valves have been designed with a removable cover for ease of field maintenance. Valves installed horizontally or inclined (flow up or down) are to be positioned with the cap facing up. Valves installed vertically may be positioned with flow up or down.

A Maintenance Check Valve Kit is available to allow the maintenance procedure of backflushing through the fire department connection without removing the Model CV-1F Check Valve from the pipe line.

The Model CV-1F Check Valves are a redesignation for the Central Figure 590F and Grinnell Figure 590F.

WARNING

The Model CV-1F Check Valve described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. ***Failure to do so may impair the performance of this device.***

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.

Technical Data

Model: CV-1F
Sizes: 2", 2½", 76.1mm, 3", 4", 139.7mm, 5", 165.1mm, 6", 8", 10" and 12"
Max. Working Pressure: 300 psi (2068 kPa)
Factory Hydro Test: 100% at 600 psi (4137 kPa)
- Seat and shell complies with test requirements of MSS SP-71, UL, FM and ULC

Approvals: UL, FM and ULC;
See Fire Protection Submittal Sheet for exact Listing / Approval information.
Body and Cap: Ductile iron conforming to ASTM A-536, Grade 65-45-12
Clapper: Stainless Steel (2" - 8") or Ductile Iron (10" and 12")
Seal: Grade "E" EPDM
Protective Coatings: Valve assembly
- Non-lead paint

Ordering Procedure

When placing an order, indicate the full product name. Please specify the quantity, valve model number, size, type of seal, Grade "E" EPDM, and part number from the following list.

Valve Size	Valve Part Number
2"	59-590-0-020
2½"	59-590-0-025
76.1mm	59-590-0-076
3"	59-590-0-030
4"	59-590-0-040
139.7mm	59-590-0-139
5"	59-590-0-050
165.1mm	59-590-0-165
6"	59-590-0-060
8"	59-590-0-080
10"	59-590-0-100
12"	59-590-0-120

Tyco Fire Products, valves, accessories and other products are available throughout the U.S., Canada, and internationally, through a network of distribution centers. You may write directly or call 215-362-0700 for the distributor nearest you.

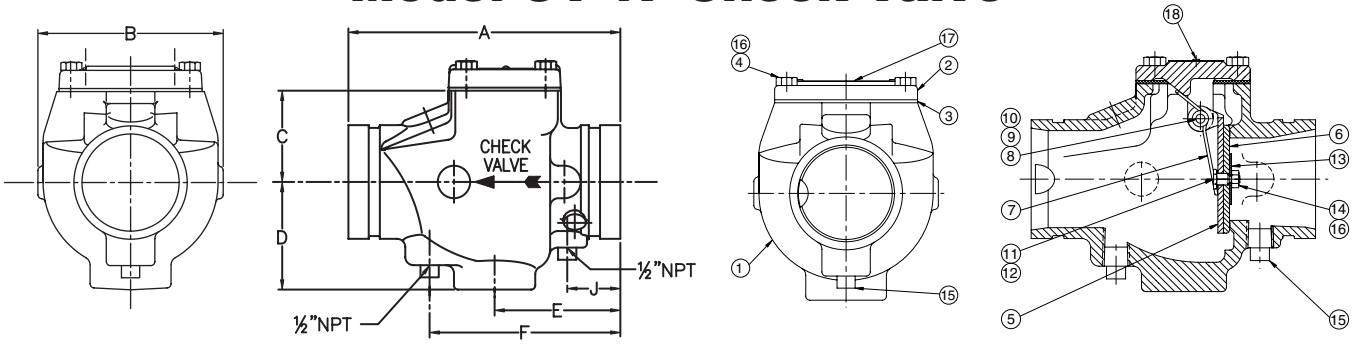
Limited Warranty

Products manufactured by Tyco Fire Products are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for and properly installed and maintained under normal use and service. This warranty will expire ten (10) years from date of shipment by Tyco Fire Products. No warranty is given for products or components manufactured by companies not affiliated by ownership with Tyco Fire Products or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association (NFPA), and/or the standards of any other Authorities Having Jurisdiction. Materials found by Tyco Fire Products to be defective shall be either repaired or replaced, at Tyco Fire Products' sole option. Tyco Fire Products neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. Tyco Fire Products shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

IN NO EVENT SHALL TYCO FIRE PRODUCTS BE LIABLE, IN CONTRACT, TORT, STRICT LIABILITY OR UNDER ANY OTHER LEGAL THEORY, FOR INCIDENTAL, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LABOR CHARGES, REGARDLESS OF WHETHER TYCO FIRE PRODUCTS WAS INFORMED ABOUT THE POSSIBILITY OF SUCH DAMAGES, AND IN NO EVENT SHALL TYCO FIRE PRODUCTS' LIABILITY EXCEED AN AMOUNT EQUAL TO THE SALES PRICE.

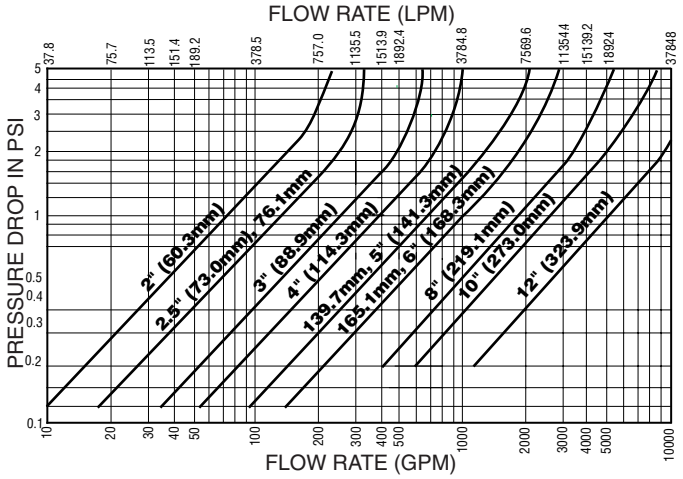
THE FOREGOING WARRANTY IS MADE IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Model CV-1F Check Valve



Nominal Dimensions									Approx.
Size Inches *mm*	A Inches *mm*	B Inches *mm*	C Inches *mm*	D Inches *mm*	E Inches *mm*	F Inches *mm*	J Inches *mm*	Cover Bolt Torq. *Lb.-ft./Nm*	Weight lbs. *Kg.*
2" *60.3*	6.75 *171.5*	4.38 *111.3*	2.55 *64.8*	2.57 *65.3*	3.25 *82.3*	4.75 *120.7*	1.62 *41.5*	15 *21*	9.0 *4.5*
2½" *73.0*	8.00 *203.2*	5.80 *147.3*	3.41 *86.6*	3.40 *86.4*	3.88 *98.6*	6.00 *152.4*	1.70 *43.2*	39 *54*	10.0 *4.5*
76.1mm	8.00 *203.2*	5.80 *147.3*	3.41 *86.6*	3.40 *86.4*	3.88 *98.6*	6.00 *152.4*	1.70 *43.2*	39 *54*	10.00 *4.5*
3" *88.9*	8.37 *212.6*	5.76 *1.46.3*	3.60 *91.4*	3.40 *86.4*	3.88 *98.6*	6.00 *152.4*	1.70 *43.2*	39 *54*	11.0 *5.0*
4" *114.3*	9.63 *244.6*	6.74 *171.2*	4.61 *117.1*	3.63 *92.2*	4.56 *115.1*	7.13 *181.1*	1.84 *46.7*	39 *54*	25.0 *11.3*
139.7mm	10.50 *266.7*	7.50 *190.5*	5.29 *134.4*	4.20 *106.7*	4.90 *124.5*	7.60 *193.0*	1.90 *48.3*	39 *54*	29.0 *13.2*
5" *141.3*	10.50 *266.7*	7.50 *190.5*	5.29 *134.4*	4.20 *106.7*	4.90 *124.5*	7.60 *193.0*	1.90 *48.3*	39 *54*	29.0 *13.2*
165.1mm	11.50 *292.1*	80.5 *204.5*	5.75 *146.1*	4.50 *114.3*	5.00 *127.0*	7.60 *193.0*	1.48 *37.6*	60 *82*	47.0 *21.3*
6" *168.3*	11.50 *292.1*	8.05 *204.5*	5.75 *146.1*	4.50 *114.3*	5.00 *127.0*	7.60 *193.0*	1.48 *37.6*	60 *82*	47.0 *21.3*
8" *219.1*	14.00 *355.6*	10.25 *260.4*	7.75 *196.9*	5.62 *142.7*	5.45 *138.4*	8.40 *213.4*	2.20 *58.9*	120 *164*	66.0 *29.9*
10" *273.0*	18.00 *457.2*	13.00 *330.2*	10.21 *259.3*	6.38 *162.1*	7.50 *190.5*	10.50 *266.7*	3.00 *76.2*	120 *164*	109.7 *49.4*
12" *323.9*	21.0 *533.4*	14.28 *362.7*	11.31 *287.2*	7.26 *184.4*	7.62 *193.5*	10.62 *269.7*	2.75 *69.9*	120 *164*	151.0 *68.0*

Detail	Part	Material	Qty.
1	Body	Ductile Iron	1
2	Cap	Ductile Iron	1
3	Gasket	Synthetic Fiber	1
4	Hex Cap Screw	Steel, Zinc Plated	AR
5	Clapper	Stainless Steel or Ductile Iron	1
6	Seal Facing	EPDM Grade "E"	1
7	Spring	Stainless Steel	1
8	Hinge Shaft	Stainless Steel	1
9	Retaining Ring	Stainless Steel	AR
10	Washer	Teflon	2
11	Retention Bolt	Stainless Steel	1
12	Seal Ring	Neoprene	1
13	Retaining Disc	Stainless Steel	1
14	Locknut	Stainless Steel	1
15	Plug-½"-14 NPT	Cast Iron	2
16	Adhesive	Thread Sealer	AR
17	Nameplate	Aluminum	1
18	Rivet	Steel	2



Note: It is good piping practice to apply a safety factor of 15% to 20% to the values in the above table for design purposes.

Care and Maintenance

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in accordance with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any authority having jurisdiction. The installing contractor or product manufacturer should be contacted relative to any questions. Any impairment must be immediately corrected. It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service.

General Notes: It is the Designer's responsibility to select products suitable for the intended service and to ensure that pressure ratings and performance data is not exceeded. Always read and understand the installation instructions (IH-1000). Never remove any piping component or correct or modify any piping deficiencies without first depressurizing and draining the system. Material and gasket selection should be verified to be compatible for the specific application.

ISO 9001 Certified Company

Angle Hose Valves

UL, ULC and FM Approved

Description

Angle hose valves feature all brass construction with forged or cast bodies for rigidity and light weight. Rated to 300 psi. Typical uses are in rack assemblies or any other application which requires a listed fire hose valve. Available in rough brass finish with a red hand wheel.
UL, ULC and FM Approved

Installation

Install in accordance with customary installation practices. Use an approved thread sealant such as **PipeFit® Thread Sealing Paste with PTFE** on the male threads to which the valve is being installed.

DO NOT OVER TIGHTEN. Over tightening of the valve during installation to the male pipe threads may crack or deform the valve body. Only use tools suitable for the installation of this product. Do not use pipe wrench extenders to increase leverage on pipe wrenches. This may result in valve damage as well as personal injury.

Specifications

Material:
Cast or forged Brass Body

Finish:
Rough Brass

Threads:
2 1/2" FNPT x FNPT
FNPT x MNST
MBCT
MQST
MONT
MPHX
MTEM
MCLV

1 1/2" FNPT x FNPT
FNPT x MNST

Fire Protection Products, Inc
6241 Yarrow Dr., Suite A, Carlsbad, CA 92011-1541
For questions: 1 800 344-1822 • 1 800 344-3775 fax • www.fppi.com

175 lb. WWP Bronze Globe Valves

Fire Protection Valve • Threaded Ends • Rubber Disc • Screw Over Bonnet

Dezincification Resistant

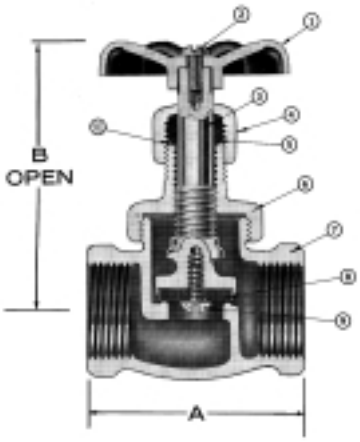
175 PSI/12.1 Bar Non-Shock Cold Water

KT-65-UL
Threaded

UL LISTED*

MATERIAL LIST

	PART	SPECIFICATION
1.	Handwheel	Aluminum
2.	Handwheel Screw	Carbon Steel Stainless Steel (1")
3.	Stem	Bronze ASTM B 584 Alloy C84400 or ASTM B 505 Alloy C84400
4.	Packing Nut	Bronze ASTM B 584 Alloy C83600 or ASTM B 16
5.	Packing	Graphite Impregnated (Non Asbestos)
6.	Bonnet	Bronze ASTM B 584 Alloy C84400
7.	Body	Bronze ASTM B 584 Alloy C84400
8.	Seat Disc	EPDM Rubber
9.	Seat Screw	Stainless Steel
10.	Pack Washer	Sheet Brass



KT-65-UL
NPT x NPT

DIMENSIONS—WEIGHTS—QUANTITIES

Size		Dimensions A		Dimensions B		Weight		Box	Master
In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.	Qty.	Ctn. Qty.
¼	8	2.00	50	2.75	70	.48	.22	10	100
⅜	10	2.00	50	2.75	70	.45	.20	10	100
½	15	2.28	58	3.12	79	.68	.31	10	60
¾	20	2.28	58	3.12	79	.74	.34	10	60
1	25	3.12	79	4.50	114	1.68	.76	5	25

***UL Listed for Trim and Drain use – sizes ½", ¾" , 1".**
Size ¼" and ⅜" supplied as KT-65.

400 lb. WWP Bronze Ball Valves

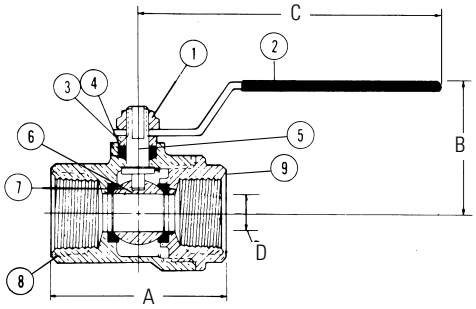
Fire Protection Valve • Standard Port • Two-Piece Body • Blowout-Proof Stem • TFE Seats

400 PSI/27.6 Bar Non-Shock Cold Water

T-580
Threaded

MATERIAL LIST

	PART	SPECIFICATION
1.	Handle Nut	Zinc Plated Steel
2.	Handle	Zinc Plated Steel Clear Chromate Plastisol Coated
3.	Packing Gland	Brass ASTM B 16 Alloy C36000
4.	Packing	TFE
5.	Stem	Silicon Bronze ASTM B 371 Alloy C69400 or ASTM B 16 Alloy C36000
6.	Ball	Brass ASTM B 16 Alloy C36000 or ASTM B 124 Alloy C37700
7.	Seat Rings	TFE
8.	Body	Bronze ASTM B 584 Alloy C84400 or Brass ASTM B 124 Alloy C37700
9.	Body Endpiece	Bronze ASTM B 584 Alloy C84400 or Brass ASTM B 124 Alloy C37700



T-580
NPT x NPT

DIMENSIONS—WEIGHTS—QUANTITIES

Size		Dimensions A		B		C		D Port		Weight		Box	Master
In.	mm.	In.	mm.	In.	mm.	In.	mm.	In.	mm.	Lbs.	Kg.	Qty.	Ctn. Qty.
½	15	2.00	51	1.56	40	3.94	100	.38	8	.57	.26	10	60
¾	20	2.28	58	1.72	44	3.94	100	.50	13	.72	.33	10	60
1	25	2.88	73	2.06	52	4.69	119	.75	19	1.25	.57	5	30
1 ¼	32	3.41	87	2.31	59	4.69	119	1.00	25	1.65	.79	4	40
1 ½	40	3.75	95	2.81	61	6.75	171	1.25	32	2.53	1.19	2	10
2	50	4.44	113	3.13	79	6.75	171	1.50	38	3.65	1.66	1	10

NIBCO INC. WORLD HEADQUARTERS • 1516 MIDDLEBURY ST. • ELKHART, IN 46516-4740 • USA • PH: 1.800.234.0227
TECH SERVICES PH: 1.888.446.4226 • FAX: 1.800.234.0557 • INTERNATIONAL OFFICE PH: +1.574.295.3221 • FAX: +1.574.295.3455
www.nibco.com

Three-way Bronze Valve

1/4” IPS UL/ULC Listed* 300 psi

Description

The 1/4" IPS three-way female threaded valve is used to facilitate the installation of sprinkler system pressure gauges. The valve provides for one inlet and two outlets. This design allows for replacement of the system gauge without shutting down the water supply to the sprinkler system. This design also allows Authoritys’ Having Jurisdication to test system pressure with an additional gauge through the second outlet. (The second outlet is normally plugged during installation with a 1/4" IPS pipe plug.)

Specifications

Materials:
- Body - Bronze
- Seat - Brass
- Handwheel - Iron

Sizes:
- 1/4” IPS

Working Pressure:
- 400 WOG

Installation

Installation of the three-way valve can be accomplished with normal field installation tools. Make sure the valve is installed according to the flow indication arrow that has been cast into the valve body. The most common installation allows for a 1/4" IPS nipple between the valve and the water supply being measured. This assures there will be adequate spacing for the sprinkler system gauge from the riser. Use either PTFE Pipe Thread Sealing Tape or a suitable pipe thread sealant such as **PipeFit® Thread Sealant Paste with PTFE** when installing the valve. **DO NOT OVERTIGHTEN THREADS. OVERTIGHTENING MAY CAUSE VALVE FAILURE.**

*UL/ULC Listed 2R97

Fire Protection Products, Inc.
6241 Yarrow Dr., Suite A, Carlsbad, CA 92011-1541
For questions: 1 800 344-1822 • 1 800 344-3775 fax • www.fppi.com

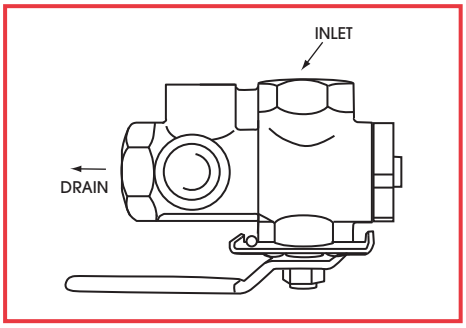
MODEL 2500

TESTANDRAIN®

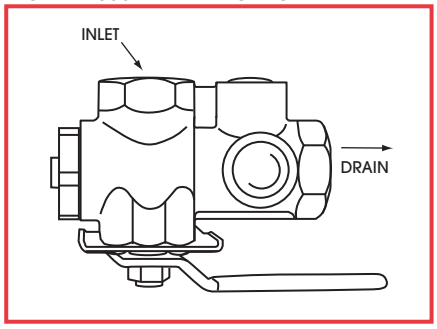
1" 1¼" 2"

- The AGF Manufacturing Inc. **Model 2500 TESTANDRAIN** Provides Both The Test Function And The Express Drain Function For A Wet Fire Sprinkler System.
- The **Model 2500** Complies With All Requirements Of NFPA-13, NFPA-13R, And NFPA-13D.
- The **Model 2500 TESTANDRAIN** Is A Multi-Direction Single Handle Ball Valve That Is Light Weight And Compact, Includes A Tamper Resistant Test Orifice, Integral Tamper Resistant Sight Glasses, And Is 300 PSI Rated.
- Available In 1" And 1¼" NPT And 2" Groove, With All Specifiable Orifice Sizes ⅜", 7/16", ½", 17/32", ⅝" (ELO), And ¾" (ESFR) And K25.
- The Orifice Size Is Noted On The Indicator Plate And The Valve Adaptor Is Tapped To Accommodate Accessories Such As A Pressure Gauge.
- Locking Kit Available Which Provides Vandal Resistance And Prevents Unintentional Alarm Activation.

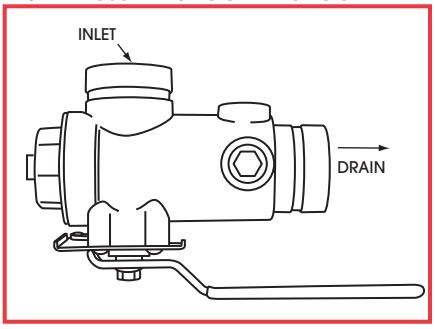
MODEL 2500 – DRAIN TO LEFT



MODEL 2500 – DRAIN TO RIGHT



MODEL 2500 - 2" GROOVE x GROOVE

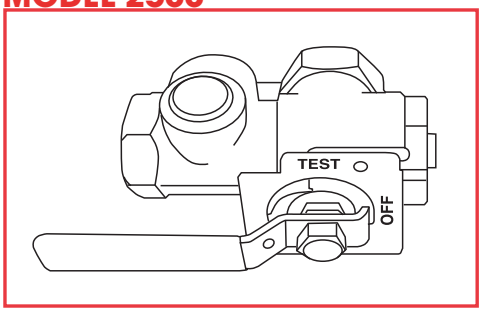


MODEL 2500

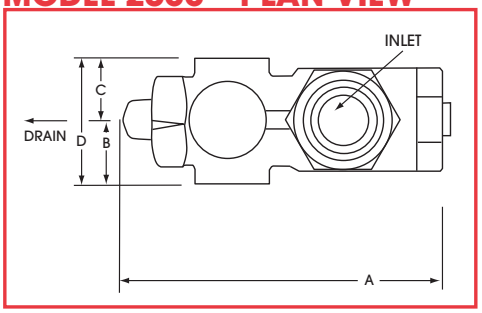
TESTANDRAIN®

MODEL 2500 (UL LISTED/FM APPROVED) 300 PSI BRONZE BALL VALVE

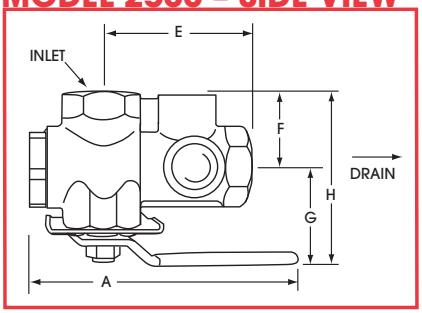
MODEL 2500



MODEL 2500 – PLAN VIEW



MODEL 2500 – SIDE VIEW



The Model 2500 answers all of the following …

From the 1999 Edition of NFPA 13

Chapter 5-14.2.4.1	Provisions shall be made to properly drain all parts of the system
Chapter 5-15.4.1	Main drain test connections shall be provided at locations that will permit flow tests of water supplies and connections.
Chapter 5-15.4.2	An alarm test connection not less than 1" terminating in a smooth bore corrosion resistant orifice, giving a flow equivalent to one sprinkler of a type having the smallest orifice shall be provided to test each waterflow alarm device.
Chapter 5-15.4.2(A)	If a test connection is terminated into a drain riser you must use an approved sight test connection to view flow.

ORIFICE SIZE AVAILABLE – 3/8", 7/16", 1/2", 17/32", ELO (5/8"), ESFR (3/4")*, K25**

DIMENSIONS

SIZE	A	B	C	D	E	F	G	H
1"	6 1/4" 158.75mm	1 1/4" 31.75mm	1 1/4" 31.75mm	2 1/2" 63.5mm	3 3/8" 85.725mm	1 13/16" 46.0375mm	2 5/8" 66.675mm	4 3/16" 106.3625mm
1 1/4"	7 9/16" 192.0875mm	1 3/8" 34.925mm	1 3/8" 34.925mm	2 3/4" 69.85mm	3 3/8" 85.725mm	2 1/8" 53.975mm	3 1/16" 77.7875mm	4 11/16" 119.0625mm
2" †	10 1/4" 260.35mm	1 13/16" 46.0375mm	1 13/16" 46.0375mm	3 5/8" 92.075mm	5 5/8" 142.875mm	2 5/8" 66.675mm	3 3/4" 95.25mm	6 3/16" 157.1625mm

*Available on 1 1/4" to 2" size units only.
** Available on 2" size units only.
† 2" M2500 is avaiable Groove x Groove only.

MATERIAL LIST

PART:	MATERIAL:
HANDLE	STEEL
STEM	ROD BRASS
BALL	C.P. BRONZE
BODY	BRONZE
VALVE SEAT	IMPREGNATED TEFLON
INDICATOR PLATE	STEEL
HANDLE LOCK	SPRING STEEL

APPROVALS:

- ❑ UL and ULC Listed
- ❑ FM Approved
- ❑ NYC-BSA NO. 720-87-SM
- ❑ CA. State Fire Marshall

USA PATENT #4741361 AND OTHER PATENTS PENDING

AGF Manufacturing Inc.
100 Quaker Lane, Malvern, PA 19355

T: (610) 240-4900 / F: (610) 240-4906
Email: info@testandrain.com
Web: www.testandrain.com

Reliability, Versatility, Code Compatibility

MADE IN U.S.A.

JOB NAME: _____

ARCHITECT: _____

ENGINEER: _____

CONTRACTOR: _____

5/02

VSR-F
VANE TYPE WATERFLOW ALARM SWITCH WITH RETARD

U.S. Pat. No. 3921989
Canadian Pat. No. 1009680
Other Patents Pending
Potter Electric, Rd., 1990

UL, ULC and CSFM Listed, FM and LPCB Approved, NYMEA Accepted, CE Marked

Service Pressure: Up to 450 PSI (31 BAR)

Minimum Flow Rate for Alarm: 10 GPM (38 LPM)

Maximum Surge: 18 FPS (5,5 m/s)

Contact Ratings: Two sets of SPDT (Form C)
15.0 Amps at 125/250VAC
2.0 Amps at 30VDC Resistive

Conduit Entrances: Two knockouts provided for 1/2" conduit

Environmental Specifications:

- Suitable for indoor or outdoor use with factory installed gasket and die-cast housing.
- NEMA 4/IP54 Rated Enclosure - use with appropriate conduit fitting.
- Temperature Range: 40°F/120°F, 4,5°C/49°C
- Non-corrosive sleeve factory installed in saddle.

Caution: This device is not intended for applications in explosive environments.

Sizes Available: Steel Pipe schedules 10 thru 40, sizes 2" thru 8"
BS 1387 pipe 50mm thru 200mm
Note: For copper or plastic pipe use Model VSR-CF.

Service Use:

Automatic Sprinkler	NFPA-13
One or two family dwelling	NFPA-13D
Residential occupancy up to four stories	NFPA-13R
National Fire Alarm Code	NFPA-72

Optional: Cover Tamper Switch Kit, Stock No. 0090018

GENERAL INFORMATION

The Model VSR-F is a vane type waterflow switch for use on wet sprinkler systems. It is UL Listed and FM Approved for use on steel pipe; schedules 10 through 40, sizes 2" thru 8" (50mm thru 200mm).

LPC approved sizes are 2" thru 8" (50mm thru 200mm).

The unit may also be used as a sectional waterflow detector on large systems.

The unit contains two single pole, double throw, snap action switches and an adjustable, instantly recycling pneumatic retard. The switches are actuated when a flow of 10 gallons per minute (38 LPM) or more occurs downstream of the device. The flow condition must exist for a period of time necessary to overcome the selected retard period.

ENCLOSURE: The unit is enclosed in a general purpose, die-cast housing. The cover is held in place with two tamper resistant screws which require a special key for removal. A field installable cover tamper switch is available as an option which may be used to indicate unauthorized removal of the cover. See bulletin no. 5400775 for installation instructions of this switch.

INSTALLATION: See Fig.2

These devices may be mounted on horizontal or vertical pipe. On horizontal pipe they should be installed on the top side of the pipe where they will be accessible. The units should not be installed within 6" (15cm) of a fitting which changes the direction of the waterflow or within 24" (60 cm) of a valve or drain.

Drain the system and drill a hole in the pipe using a circular saw in a slow speed drill. The 2" (50mm) and 2 1/2" (65mm) devices require a hole with a diameter of 1 1/4" + 1/8" - 1/16" (33mm ±2mm). All other sizes require a hole with a diameter of 2" ±1/8" (50mm ±2mm).

Clean the inside pipe of all growth or other material for a distance equal to the pipe diameter on either side of the hole.

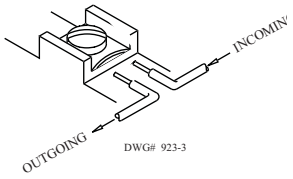
Roll the vane so that it may be inserted into the hole; do not bend or crease it. Insert the vane so that the arrow on the saddle points in the direction of the waterflow. Install the saddle strap and tighten nuts alternately to an eventual 50 ft-lbs. (68 n-m) of torque (see Fig. 2). The vane must not rub the inside of the pipe or bind in any way.

Specifications subject to change without notice.

VSR-F
VANE TYPE WATERFLOW ALARM SWITCH WITH RETARD

FIG. 1

SWITCH TERMINAL CONNECTIONS CLAMPING PLATE TERMINAL



CAUTION:
An uninsulated section of a single conductor should not be looped around the terminal and serve as two separate connections. The wire must be severed, thereby providing supervision of the connection in the event that the wire becomes dislodged from under the terminal.

FIG. 2

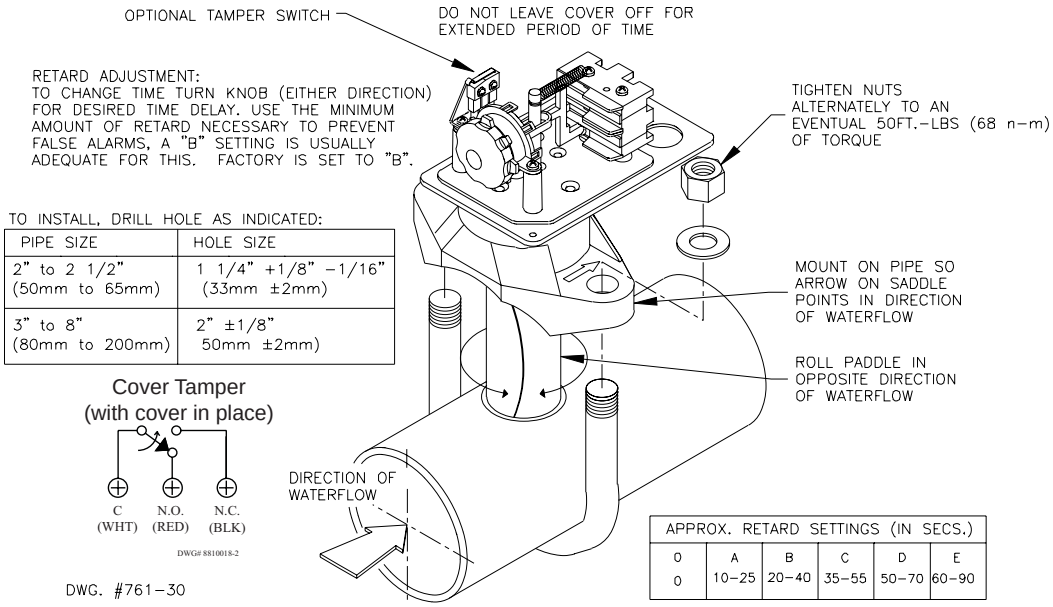
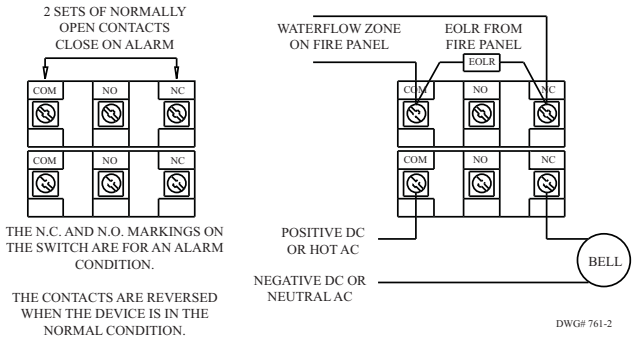


FIG. 3 TYPICAL ELECTRICAL CONNECTIONS

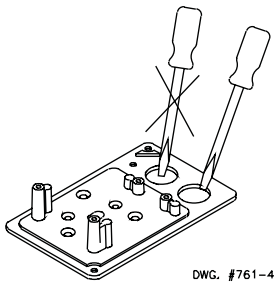


NOTES:

1. The Model VSR-F has two switches, one can be used to operate a central station, proprietary or remote signaling unit, while the other contact is used to operate a local audible or visual annunciator.
2. A condition of LPC Approval of this product is that the electrical entry must be sealed to exclude moisture.
3. For supervised circuits see "Switch Terminal Connections" drawing and caution note (Fig. 1).

FIG. 4

To remove knockouts: Place screwdriver at edge of knockouts, not in the center.



APPLICATION WARNING!

Due to the possibility of unintended discharges caused by pressure surges, trapped air, or short retard times, waterflow switches that are monitoring wet pipe sprinkler systems should not be used as the sole initiating device to discharge AFFF, deluge, or chemical suppression systems.

TESTING

The frequency of inspection and testing for the model VSR-F and its associated protective monitoring system should be in accordance with applicable NFPA Codes and Standards and/or the authority having jurisdiction (manufacturer recommends quarterly or more frequently).

If provided, the inspector's test valve, that is usually located at the end of the most remote branch line, should always be used for test purposes. If there are no provisions for testing the operation of the flow detection device on the system, application of the VSR-F is not recommended or advisable.

A minimum flow of 10 gpm (38 Lpm) is required to activate this device.

IMPORTANT NOTICE: Please advise the person responsible for testing of the fire protection system that this system must be tested in accordance with the testing instructions.

POTTER
The Symbol of Protection

BELLS
PBA-AC & MBA-DC

UL, ULC, and FM Approved

Sizes Available: 6" (150mm), 8" (200mm) and 10" (250mm)

Voltages Available: 24VAC
120VAC
12VDC (10.2 to 15.6) Polarized
24VDC (20.4 to 31.2) Polarized

Service Use: Fire Alarm
General Signaling
Burglar Alarm

Environment: Indoor or outdoor use (See Note 1)
-40° to 150°F (-40° to 66°C)
(Outdoor use requires weatherproof backbox.)

Termination: AC Bells - 4 No. 18 AWG stranded wires
DC Bells - Terminal strip

Finish: Red powder coating

Optional: Model BBK-1 weatherproof backbox
Model BBX-1 deep weatherproof backbox

These vibrating type bells are designed for use as fire, burglar or general signaling devices. They have low power consumption and high decibel ratings. The unit mounts on a standard 4" (101mm) square electrical box for indoor use or on a model BBK-1 weatherproof backbox for outdoor applications. Weatherproof backbox model BBK-1, Stock No. 1500001.

ALL DC BELLS ARE POLARIZED AND HAVE BUILT-IN TRANSIENT PROTECTION:

Size inches (mm)	Voltage	Model Number	Stock Number	Current (Max.)	Typical dB at 10 ft. (3m) (2)	Minimum dB at 10 ft. (3m) (1)
6 (150)	12VDC	MBA126	1750070	.12A	85	76
8 (200)	12VDC	MBA128	1750080	.12A	90	77
10 (250)	12VDC	MBA1210	1750060	.12A	92	78
6 (150)	24VDC	MBA246	1750100	.06A	87	77
8 (200)	24VDC	MBA248	1750110	.06A	91	79
10 (250)	24VDC	MBA2410	1750090	.06A	94	80
6 (150)	24VAC	PBA246	1806024	.17A	91	78
8 (200)	24VAC	PBA248	1808024	.17A	94	77
10 (250)	24VAC	PBA2410	1810024	.17A	94	78
6 (150)	120VAC	PBA1206	1806120	.05A	92	83
8 (200)	120VAC	PBA1208	1808120	.05A	99	84
10 (250)	120VAC	PBA12010	1810120	.05A	99	86

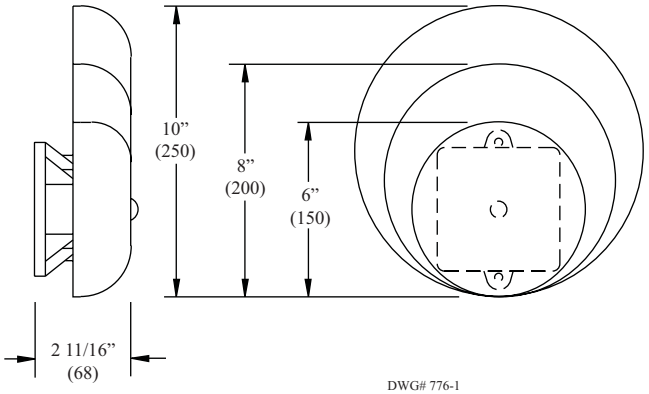
Notes:

1. Minimum dB ratings are calculated from integrated sound pressure measurements made at Underwriters Laboratories as specified in UL Standard 464. UL temperature range is -30° to 150°F (-34° to 66°C).
2. Typical dB ratings are calculated from measurements made with a conventional sound level meter and are indicative of output levels in an actual installation.

Potter Electric Signal Company • 2081 Craig Road, St. Louis, MO, 63146-4161 • Phone: 800-325-3936/Canada 888-882-1833 • www.pottersignal.com

DIMENSIONS
INCHES (mm)

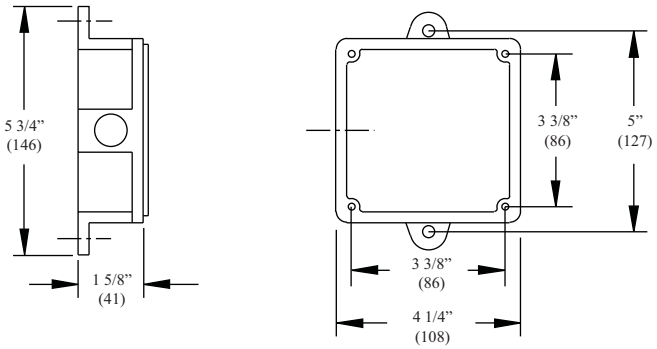
FIG. 1 BELLS



DWG# 776-1

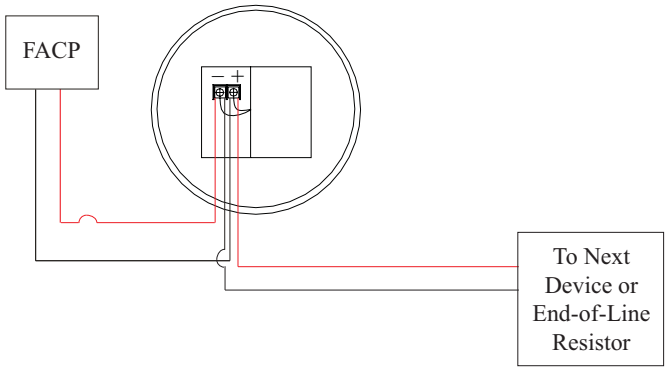
FIG. 2 WEATHERPROOF BACKBOX

BOX HAS ONE THREADED 1/2" CONDUIT ENTRANCE

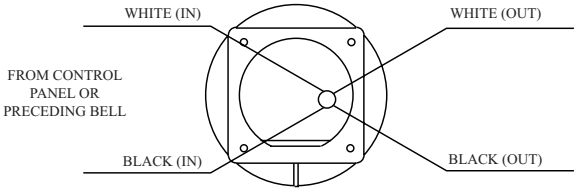


DWG# 776-2

FIG. 3 WIRING (REAR VIEW)



A.C. BELLS



CAUTION:
WHEN ELECTRICAL SUPERVISION IS REQUIRED USE IN AND OUT LEADS AS SHOWN.

NOTES:

1. WHEN USING AC BELLS, TERMINATE EACH EXTRA WIRE SEPARATELY AFTER LAST BELL.
2. END-OF-LINE RESISTOR IS NOT REQUIRED ON AC BELLS.

DWG# 776-3

INSTALLATION

1. The bell shall be installed in accordance with NFPA 13, 72, or local AHJ. The top of the device shall be no less than 90" AFF and not less than 6" below the ceiling.
2. Remove the gong.
3. Connect wiring (see Fig. 3).
4. Mount bell mechanism to backbox (bell mechanism must be mounted with the striker pointing down).
5. Reinstall the gong (be sure that the gong positioning pin, in the mechanism housing, is in the hole in the gong).
6. Test all bells for proper operation and observe that they can be heard where required (bells must be heard in all areas as designated by the authority having jurisdiction).

SECTION V

MISCELLANEOUS

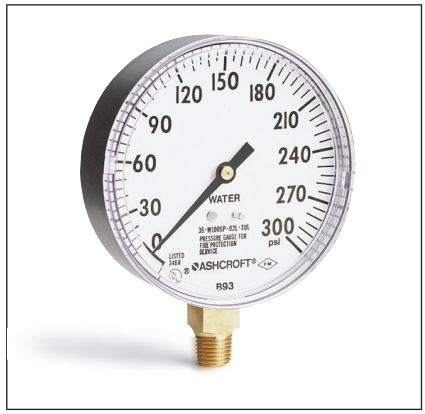
ASHCROFT®

Fire Protection, Sprinkler Service Gauge Type 1005P, XUL ASME B 40.1 Grade B (±3-2-3% of span)

- ***Underwriters Laboratory listed and Factory Mutual approved***
- ***Corrosion-resistant ABS case***
- ***Heat-resistant polycarbonate push-in window***
- ***Patented PowerFlex™ movement with polyester segment***
- ***True Zero™ indication, a unique safety feature***

Ashcroft® fire protection sprinkler gauges are Underwriters Laboratory listed and Factory Mutual approved for fire protection sprinkler service. The case material on Type 1005P, XUL gauges is ABS. The 0-300 psi pressure range is used on "wet" systems where water is available to the sprinkler heads. The 0-80 retard to 250 psi pressure range is used on dry systems where the lines are filled with air pressure until system activation.

The patented Power*Flex* movement with polyester segment is designed to provide unequalled shock and vibration resistance resulting in superior performance and extended gauge life.



True Zero indication, a standard feature on these gauges, reduces the potential risk of installing a damaged gauge on your equipment.

GAUGE SPECIFICATIONS

Type no.: 1005P, XUL

Accuracy: ASME B 40.1 Grade B (±3-2-3% of span)

Size: 3½″

Case: ABS (Polycarbonate blend)

Ring: None

Window: Polycarbonate, push-in

Dial: Black figures on white background

Pointer: Black, aluminum

Bourdon tube: "C" shaped bronze

Movement: Patented Power*Flex* with polyester segment

Socket: Brass

Restrictor: None

Operating temperature: –40°F to 150°F

Connection: ¼ NPT lower

Ranges: 0-300 psi (water)
0-80 retard to 250 psi (air)
UL 393 Listed, UL of Canada Listed and FM approved.
Equivalent (single or dual scale) metric scales are available

GAUGE OPTIONS

Customized dials

Other UL listed ranges on application

NOTES

UL LISTED

FM

LOOK FOR THESE AGENCY MARKS ON OUR PRODUCTS

TO ORDER THIS TYPE 1005P, XUL GAUGE:

Select:	35	W	1005	P	H	02L	XUL	300#

1. Dial Size: 3½″
2. Patented Power*Flex*™ Movement
3. Case Type Number: 1005
4. Case Type Material: ABS
5. Socket Material: Brass
6. Connection Size/Location: ¼ NPT lower
7. UL listed, FM approved
8. Range: 300 psi

Identification Signs

Description

Manufactured from .020" white coated aluminum. All sign types are screen printed with a fade resistant red ink. Each sign is shipped with a clear protective plastic coating which can be removed at time of installation. Each sign type meets or exceeds NFPA13 requirements. All signs (except 7" round) are drilled in four corners to allow for easy installation. All signs (except 7" round) may be installed with sign chain or with any fastener that is suitable for the material that the sign is being attached. The 7" round bell signs are center drilled to allow for installation directly to the bell gong assembly. Type “A” 9" x 7" Control valve signs are drilled with the same four hole pattern as Type "B" 6" x 2" signs to allow for attachment of Type “B” to Type "A".

Installation

Installation of aluminum signs is accomplished by several methods. The most common installation procedure is to use #16 Single Jack chain to hang the sign on the area being identified. Since all of the above mentioned signs are predrilled at all four corners, the last link of the chain can be opened and hooked through the top holes on the signs and hung on the appropriate valve or piping. The signs may also be fastened to a flat surface with fasteners appropriate to the base material. (The 9" x 7" Fire Alarm Bell sign must be drilled if it is to be attached directly to the bell gong.)

Specifications

Material:

.020" aluminum with removable plastic protective coating

Sizes:

6" x 2"
4" x 6"
5" x 7"
9" x 7"
12" x 10"
8.5" x 11"

See current catalog for a full listing of all available signs.

Fire Protection Products, Inc
6241 Yarrow Dr., Suite A, Carlsbad, CA 92011-1541
For questions: 1 800 344-1822 • 1 800 344-3775 fax • www.fppi.com

SPARE SPRINKLER HEAD STORAGE CABINET

Description

Fire Protection Products, Inc. Spare Sprinkler Head Cabinets are designed to allow for spare sprinkler head storage as required by NFPA guidlines. The Spare Sprinkler Head Cabinets are available in four configurations. Three head, six head, six head ESFR and twelve head. All four styles are manufactured with "knockouts" to accomodate the most common size sprinklers. The shelf is located to allow for the storage of a typical sprinkler head wrench. Each cabinet is finished with a red enamel finish. Each spare head cabinet comes with a hinged door the remains closed to protect the spare sprinklers from the elements and features two holes on the back panel to allow for attachment to most surfaces utilizing the approriate fasteners.

Installation

Select the correct Spare Sprinkler Head Cabinet in accordance with the Automatic Sprinkler Systems Handbook. As per the 1989 Edition the correct number of spare sprinkler is as follows:

"0-300 sprinklers, not less than 6
300-1000, not less than 12
1000 or more, not less than 24.

Stock of spare sprinklers shall include all types and ratings installed."*

Once the correct Spare Sprinkler Head Cabinet has been selected, installation is accomplished by inserting the correct fastener in each of the two holes inside the cabinet , securing the cabinet securely to the wall. The insert the correct number and type of sprinklers in accordance with the "handbook".

***final determination is subject to approval by the Authority Having Jurisdiction (AHJ).**

Specs

Material:

Painted plain steel

Finish:

Red enamel

Styles:

3 Spare sprinkler, 1/2 or 3/4
6 Spare sprinklers, 1/2 or 3/4
6 Spare, ESFR, 1/2 , 3/4 or 1"
12 Spare sprinklers 1/2 or 3/4

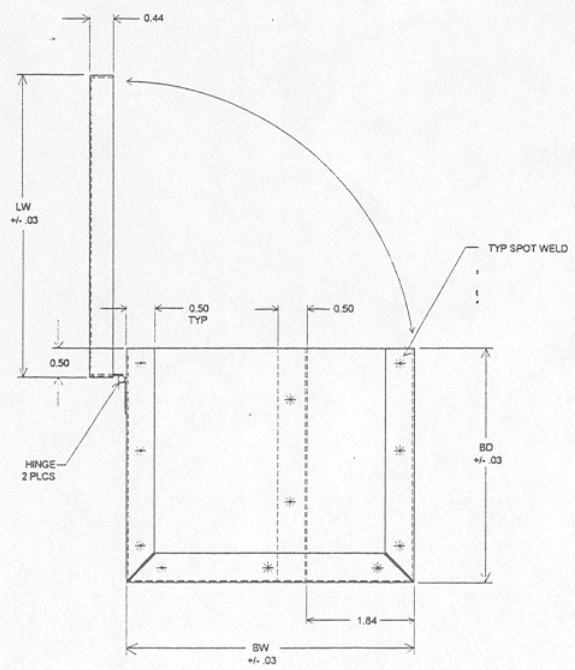
For questions:
1 800 344-1822
1 800 344-3775 fax
http://www.fppi.com
sales@fppi.com

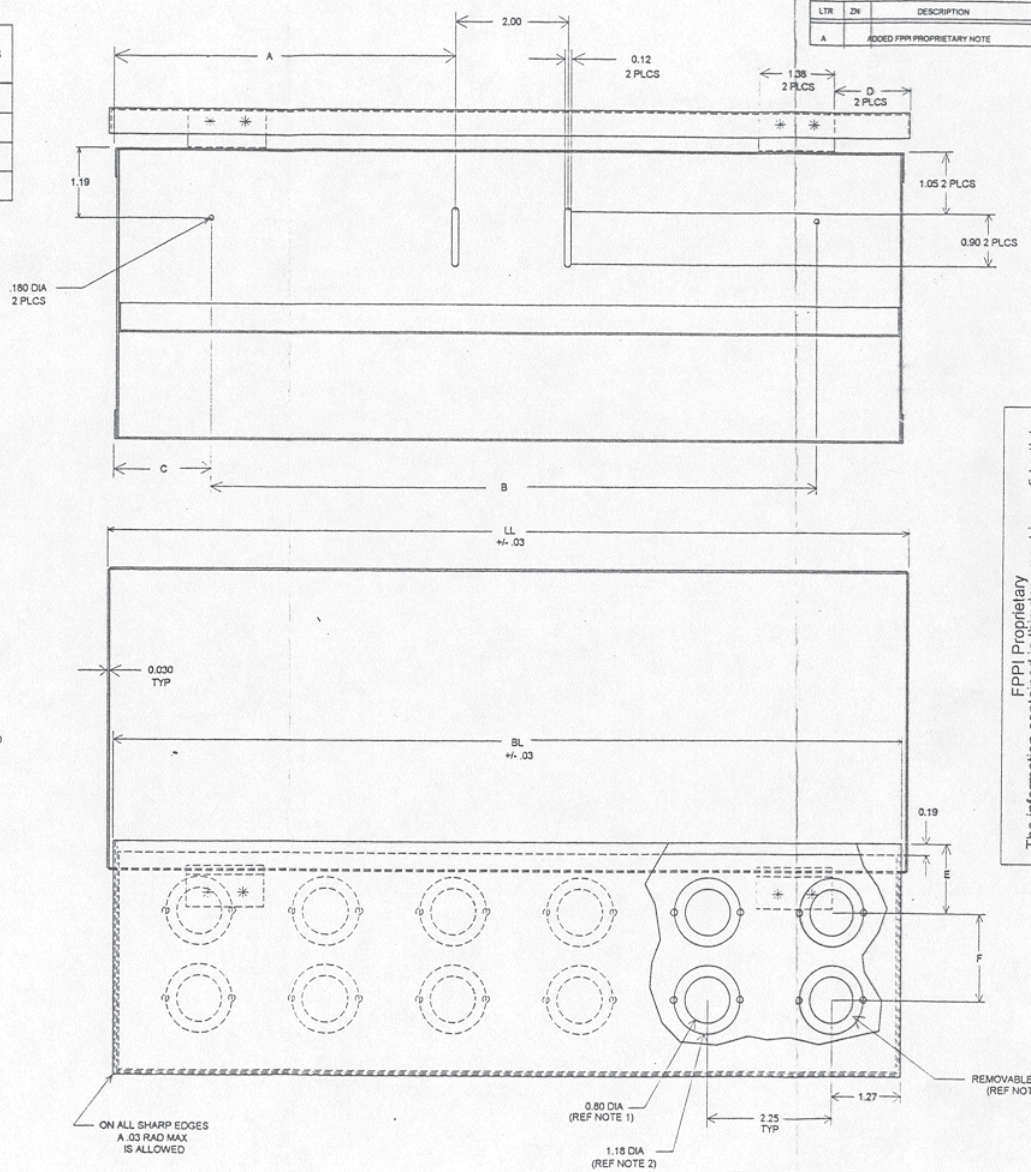
PART NO.	DIMENSIONS											SPRINKLER STORAGE CAPACITY	ROWS
	BL	BW	BD	LL	LW	A	B	C	D	E	F		
02-400	14.03	5.00	4.00	14.25	5.19	6.00	10.75	1.69	1.38	1.19	1.50	12	2
02-401	14.03	5.00	2.31	14.25	5.19	6.00	10.75	1.69	1.38	1.00	N/A	6	1
02-402	7.12	5.00	2.37	7.31	5.25	2.50	4.94	1.12	.65	1.00	N/A	3	1
02-403	14.03	6.25	3.12	14.25	6.50	6.00	10.75	1.69	1.12	1.50	N/A	6 (ESFR) *	1

* ESFR OR ANY OTHER LARGE FRAMED SPRINKLERS

NOTES:

1. THIS HOLE (.80 DIA) ALLOWS FOR 1/2" IPS SPRINKLER JEADS.
2. THIS HOLE (1.180 DIA) ALLOWS FOR 3/4" IPS SPRINKLER JEADS.
3. REMOVABLE INSERTS ARE FOR LARGE ORFICE (3/4" IPS) SPRINKLER JEADS.
4. THIS DRAWING SHOWS PART NO. 02-400 AT FULL SCALE





REVISION				
LTR	ZN	DESCRIPTION	DWN	DATE
A		ADDED FPPI PROPRIETARY NOTE	J.D.	6/20/94

TOLERANCE			DRAWN		
XXX	±	.005	J. DUNN	4/94	FIRE PROTECTION PRODUCTS
XX	±	.01	CHECKED		
X	±	1	ENGINEER		TITLE
ANGLE	±	2 DEG	R. GREENSLATE	4/94	BOX, STORAGE, SPRINKLER HEAD
MATERIAL			FINISH		
.03 THK COLD ROLL STEEL			FIRE ENGINE RED BAKED ENAMEL		SIZE D DWG NO FPP-042194 REV A
					DO NOT SCALE SHEET 1 OF 1

FireDam 150+ Acrylic Latex Caulk

Product Data

Fill, Void or Cavity Materials
For Use in Through-Penetration
Firestop Systems and Joint Systems
See UL Fire Resistance Directory
8R57

1. Product Description

3M™ FireDam™ 150+ Caulk is a ready to use, gun-grade, one-component acrylic latex elastomer that cures upon exposure to the atmosphere to form a monolithic flexible seal. 3M™ FireDam™ 150+ Caulk firestops openings and penetrations through floor slabs, walls and other fire-rated building partitions and assemblies. 3M™ FireDam™ 150+ Caulk, when installed properly helps control the spread of fire before, during and after exposure to fire.

3M™ FireDam 150+ Caulk Features
Sealant remains elastomeric, weather resistant and exhibits excellent adhesion to a full range of construction substrates.

- Excellent adhesion
- Compression/extension recovery of +/-19% of original joint width
- Re-enterable/repairable
- Cures upon exposure to atmosphere
- Applied with conventional caulking equipment
- Paintable
- Water clean-up
- No sag formulation
- Two colors, sky blue and limestone
- Resists dirt pick-up after cure
- No priming required

2. Applications

A. 3M™ FireDam™ 150+ Caulk is ideal for sealing construction joints and through-penetrations such as, metallic pipes, conduits, power and communication cables and conduits. Controls the spread of fire, limits the spread of noxious gas, smoke and water. Maintains the integrity of fire rated construction.

Primary firestopping applications:

- Telephone, signal and control and power cables
- Metallic conduit
- Metallic pipes
- Construction joints

B. Limitations
Do not apply 3M™ FireDam™ 150+ Caulk when surrounding temperature is less than 40°F (4°C) and in conditions when seals may be exposed to rain or water spray for 12 to 18 hours. Also do not apply under the following conditions.

- Building materials that bleed oil, plasticizers or solvent (e.g., impregnated wood, oil based caulks, green or partially vulcanized rubber)
- Wet or frost-coated surfaces
- Areas that are continuously damp or immersed in water

3. Specifications

Materials

A. The fire stopping sealant is a one component, ready to use, gun grade, acrylic latex elastomer. The sealant shall be listed by independent test agencies such as UL, FM or Intertek/OPL and be tested to and pass the criteria of ASTM E 814 (UL 1479) Standard Test Method for Fire Tests of Through-Penetration Fire Stops and ASTM E 1966 (UL 2079) Standard Test Method for Fire-Resistive Joint Systems. It shall comply with the requirements of the NEC (NFPA 70), BOCAI, ICBO, SBCCI, IBC and NFPA 101.

Typically Specified Sections
07270 (1988) Firestopping
07840 (1995) Firestopping

4. Performance

A. Typical Physical Properties (As Supplied)

Slump Resistance (ASTM D 2202):	Pass
Extrusion Rate:	25-30 g/sec
Dry to Touch (77°F, 25°C, 50% R.H.):	30-60 minutes
Cure Time (77°F, 25°C, 50% R.H.):	14-45 days (Depends on thickness)
Application Temperature Range (ASTM C 1299):	40° to 122°F (4° to 50°C)
Color:	Blue and Limestone
Specific Gravity:	1.50

Typical Performance Properties (As Cured)

Hardness (ASTM C 66 Shore A):	45
Elongation at Break (ASTM D 412):	150%
Tensile Strength:	85 psi (0.59 MPa)
Volume Shrinkage (ASTM C 1241):	28%
Recovery (ASTM C 736):	Pass
Artificial Weathering (ASTM C 732):	Pass
Low Temp. Flexibility (ASTM C 734):	Pass
UV and Ozone Resistance:	Good
Service Temperature Range:	-20° to 180°F (-28° to 82°C)
ASTM E 84	
Flame Spread Index:	0
Smoke Developed Index:	0

Note: Contact 3M for current sales specification

B. Firestopping Properties

Meets the criteria of ASTM E 814 Standards Test Method for Fire Tests of Through-Penetration Fire Stop and ASTM E 1966 Standard Test Method for Fire Resistive Joint Sytems. Consult current independent test laboratories directories for listings.

C. Firestopping Code Requirements

ICBO Uniform Building Code (1997 Edition)

702
DEFINITIONS

706
CONSTRUCTION JOINTS

708
WOOD FRAME CONSTRUCTION FIREBLOCKING

709
WALL & PARTITION PENETRATION PROTECTION

709.3.2.2
CURTAIN WALL GAP

710
FLOOR/CEILING OR ROOF/CEILING PENETRATION PROTECTION

711.3
SHAFT ALTERNATIVE

714
THROUGH-PENETRATION FIRESTOPS F&T REQUIREMENTS

UBC STANDARD 7-1
EQUIVALENT TO ASTM E 119

UBC STANDARD 7-5
EQUIVALENT TO ASTM E 814

NFPA 5000 (2006 EDITION)

8.8
PENETRATIONS

8.9
JOINTS

SBCCI Standard Building Code (1997 Edition)

104.2.4
PLANS MUST SHOW HOW INTEGRITY IS MAINTAINED FOR ASSEMBLIES PENETRATED

202
DEFINITIONS

705.3
WOOD FRAME CONSTRUCTION FIREBLOCKING

705.3.1.5
CURTAIN WALL GAP

705.4 (GENERAL)
PENETRATIONS OF FIRE RATED ASSEMBLIES

705.5 (WALLS)

705.6 (FLOORS)

705.7
FIRE RESISTANT JOINT SYSTEMS

INTERNATIONAL BUILDING CODE (2003 Edition)

702
DEFINITIONS

712
PENETRATIONS

713
FIRE RESISTANT JOINT SYSTEMS

BOCA Basic/National Building Code (1996 Edition)

702.0
REVISED AND EXPANDED DEFINITIONS FOR PENETRATIONS AND JOINTS

703.1
CONSTRUCTION DOCUMENTS SHALL INDICATE DETAILS AND MATERIALS FOR PROVIDING RATINGS AT JOINTS AND PENETRATIONS

703.1.1
PENETRATIONS AND JOINTS SHALL NOT BE CONCEALED FROM VIEW BEFORE INSPECTION

703.2
BUILDINGS FOR MORE THAN TWO STORIES SHALL INDICATE ALL PENETRATIONS

704.1.1
SUFFICIENT DATA SHALL BE AVAILABLE TO JUSTIFY UNTESTED MATERIALS USED FOR RESTORATION OF FIRE RATINGS

707.0
FIRE WALLS AND PARTY WALLS

707.10
PENETRATIONS - REFERS TO 714

707.8
JOINTS - REFERS TO 709.7

709.0
FIRE SEPARATION ASSEMBLIES

709.6
PENETRATIONS - REFER TO 714

709.7
JOINTS

711.0
FIRE PARTITIONS

711.6
PENETRATIONS - REFERS TO 714

711.7
JOINTS - REFER TO 709.7

713.0
FLOOR/CEILING AND ROOF/CEILING ASSEMBLIES

713.2
CURTAIN WALL GAP

713.4
PENETRATIONS - REFERS TO 714

713.5
JOINTS - REFERS TO 709.7

714.0
PENETRATIONS - ALL REQUIREMENTS (GENERAL)

714.1 THROUGH 714.1.6.2
WALL ASSEMBLIES

714.2 THROUGH 714.2.6.5
FLOOR/CEILING AND ROOF/CEILING ASSEMBLIES

714.3 THROUGH 714.3.2
NONRATED ASSEMBLIES

721.0
FIREBLOCKING AND DRAFTSTOPPING

NFPA Life Safety Code 101 (1997 Edition)

6-2.3.2.4
PENETRATIONS AND MISC. OPENINGS &FIRE BARRIERS

6.2.4.2, EXCEPTION
5 OPENINGS (EXPANSION OR SEISMIC JOINTS) IN FLOORS

APPENDIX
A-6-2.4.2

6-3.6.1
PENETRATIONS AND MISC. OPENINGS IN FLOORS AND SMOKE BARRIERS

NFPA #221

FIRE WALLS AND BARRIERS

NFPA Code 70 NEC National Electric Code

300-21 FIRESTOPPING

CABO One and Two Family Dwelling Code (1995 Edition)

602.7
FIRESTOPPING (FIREBLOCKING IN OTHER MODEL CODES)

5. Installation Techniques

Consult your 3M Authorized Fire Protection Products Distributor/Dealer for drawings and system details.

Installation Notes:

- Clean surface of the opening and all penetrating items to allow proper adhesion of firestop materials.
- Install damming materials as necessary to meet requirements of appropriate system.
- Install the proper amount of 3M™ FireDam™ 150+ Caulk for appropriate system and rating.

6. Maintenance

3M™ FireDam™ 150+ Caulk is stable under normal storage conditions. Shelf life is 12 months from date of manufacture when stored in a clean, dry area with temperatures between 40°F and 90°F (4°C and 32°C). Avoid repeated freeze/thaw of 3M™ FireDam™ 150+ Caulk while still in packaging.

7. Availability

3M™ FireDam™ 150+ Caulk is available from 3M Authorized Fire Protection Products Distributors and Dealers. Caulk is available in 10.1 oz., 20.0 oz. sausage, 28.0 oz. cartridges and 4.5 gal. pail.

8. Safe Handling Information

Consult Material Safety Data Sheet prior to handling and disposing of 3M™ FireDam™ 150+ Caulk.

Warranty and Limited Remedy. This product will be free from defects in materials and manufacture for a period of ninety (90) days from date of purchase. **3M MAKES NO OTHER WARRANTIES INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.** User is responsible for determining whether the 3M product is fit for a particular purpose and suitable for user's application. If this 3M product is defective within the warranty period stated above, your exclusive remedy and 3M's sole obligation shall be, at 3M's option, to replace the 3M product or refund the purchase price of the 3M product.

Limitation of Liablility. Except where prohibited by law, 3M will not be liable for any loss or damage arising from this 3M product, whether direct, indirect, special, incidental or consequential, regardless of the legal theory asserted, including warranty, contract, negligence or strict liability.

3M

Building and Commercial Services Division

3M Center, Bldg. 223-2S-24
St. Paul, MN 55144-1000
Phone 800-328-1687
Fax 888-362-2737
www.3m.com/firestop

Printed in U.S.A. Bolger 7020246

 98-0400-4974-8 Aug. 2006

Fire Barrier CP 25WB+Caulk

Product Data

FILL VOID OR CAVITY MATERIALS
CLASSIFIED BY UNDERWRITERS
LABORATORIES, INC.® FOR USE IN
THROUGH-PENETRATION
FIRESTOP SYSTEMS (XHEZ).
SEE CURRENT UL FIRE
RESISTANCE DIRECTORY
50L6, 90G9

1. Product Description

3M™ Fire Barrier CP 25WB+ Caulk is a premium elastomeric latex caulk designed for use as a one-part fire, smoke, noxious gas and water sealant. In addition, the unique intumescent property of this material (expands when heated) means that as cable or pipe insulation is consumed by fire, CP 25WB+ Caulk expands to maintain the penetration seal.

CP 25WB+ Caulk features superior adhesion strength, caulk rate and no-sag application with expanded UL Classified fire protection systems plus a halogen-free formula.

3M Fire Barrier CP 25WB+ Caulk can be installed with a standard caulking gun, pneumatic pumping equipment or it can be easily applied with a putty knife or trowel. CP 25WB+ Caulk will bond to concrete, metals, wood, plastic and cable jacketing. No mixing is required.

CP 25WB+ Caulk Features

- Water Base: Easy clean up, no special handling, routine disposal.
- Intumescent: Expands when heated to seal around items consumed by fire.
- Endothermic: Absorbs heat energy, releases chemically bound water.
- Thixotropic: Will not sag or run in overhead or vertical applications.
- Halogen-free.
- Fast dry: Tack-free in approximately 10-15 minutes.
- Paintable. (Best results obtained after 72 hour cure.)
- Minimal shrinkage.
- Brown color.
- Water seal: Seals against inadvertant water spills in the unexpanded state.
- High caulk rate: 1000 g/min. with in. nozzle.
- Point contact allowed.
- Continuous Operating Temperature not to exceed 120°F (48°C).

2. Applications

Use to seal construction openings, blank openings and penetrating items against the passage of flame, noxious gas, smoke and water. Restores fire rated construction to original integrity. Also for use with 3M Brand Fire Barrier FS195+ Wrap/Strip and CS-195+ Composite Sheet.

3. Specifications

Product

The firestopping caulk shall be a one-part, intumescent, latex elastomer. The caulk shall be capable of expanding a minimum of 3 times at 1000°F. The material shall be thixotropic and be applicable to overhead, vertical and horizontal firestops. The caulk shall be listed by independent test agencies such as UL or FM and be tested to, and pass the criteria of, ASTM E 814 Fire Test, tested under positive pressure. It shall comply with the requirements of the NEC (NFPA-70), BOCA, ICBO, SBCCI and NFPA Code #101.

Typically Specified Divisions

Division 7	Thermal and Moisture Protection Firestopping
07270	
Division 13	Special Construction Fire Suppression and Supervisory Systems
13900	
Division 15	Mechanical
15250	Mechanical Insulation Fire Protection
15300	
Division 16	Electrical
16050	Basic Electrical Materials and Methods

4. Performance

A. Typical Physical Properties

	Unit	Value
Tack Free Time (ASTM C679-87)	Minutes at 72°F (22°C)	10-15
Expansion at 662°F (350°C)	X	2.0-3.0
Color	—	Reddish Brown
Density	Lb./gal. (Kg/l)	11.2 (1,35)
Adhesion	All construction substrates	Very Good
Application	Method	Caulk guns, trowel, spatula pressurized pumps
Durometer (hardness)	Shore A	70
ASTM E 84		
Flame Spread	—	5
Smoke Development	—	0
Solids	Percent (%) by weight	79
VOC	Percent (%) by weight	0
Odor	—	Pleasant, non-irritating
Flow Rate	Grams/min.	1000
1/4 in. (6,35 mm) nozzle at 50 psi		
Boeing Flow (Sag Characteristics)	Inches	0

B. Firestopping Properties

Meets the criteria of ASTM E 814 Fire Test, tested under positive pressure. Consult current UL Fire Resistance Directory for systems listed under 3M Product CP 25WB+ Caulk.

C. Firestopping Code Requirements

ICBO Uniform Building Code (1997 Edition)	SBCCI Standard Building Code (1997 Edition)	BOCA Basic/National Building Code (1996 Edition)	NFPA Life Safety Code 101 (1997 Edition)
702 DEFINITIONS 706 CONSTRUCTION JOINTS 708 WOOD FRAME CONSTRUCTION FIREBLOCKING 709 WALL & PARTITION PENETRATION PROTECTION 709.3.2.2 CURTAIN WALL GAP 710 FLOOR/CEILING OR ROOF/CEILING PENETRATION PROTECTION 711.3 SHAFT ALTERNATIVE 714 THROUGH-PENETRATION FIRESTOPS F&T REQUIREMENTS UBC STANDARD 7-1 EQUIVALENT TO ASTM E 119 UBC STANDARD 7-5 EQUIVALENT TO ASTM E 814	104.2.4 PLANS MUST SHOW HOW INTEGRITY IS MAINTAINED FOR ASSEMBLIES PENETRATED 202 DEFINITIONS 705.3 WOOD FRAME CONSTRUCTION FIREBLOCKING 705.3.1.5 CURTAIN WALL GAP 705.4 (GENERAL) PENETRATIONS OF FIRE RATED ASSEMBLIES 705.5 (WALLS) 705.6 (FLOORS) 705.7 FIRE RESISTANT JOINT SYSTEMS	702.0 REVISED AND EXPANDED DEFINITIONS FOR PENETRATIONS AND JOINTS 703.1 CONSTRUCTION DOCUMENTS SHALL INDICATE DETAILS AND MATERIALS FOR PROVIDING RATINGS AT JOINTS AND PENETRATIONS 703.1.1 PENETRATIONS AND JOINTS SHALL NOT BE CONCEALED FROM VIEW BEFORE INSPECTION 703.2 BUILDINGS FOR MORE THAN TWO STORIES SHALL INDICATE ALL PENETRATIONS 704.1.1 SUFFICIENT DATA SHALL BE AVAILABLE TO JUSTIFY UNTESTED MATERIALS USED FOR RESTORATION OF FIRE RATINGS 707.0 FIRE WALLS AND PARTY WALLS 707.10 PENETRATIONS - REFERS TO 714 707.8 JOINTS - REFERS TO 709.7 709.0 FIRE SEPARATION ASSEMBLIES 709.6 PENETRATIONS - REFER TO 714 709.7 JOINTS 711.0 FIRE PARTITIONS 711.6 PENETRATIONS - REFERS TO 714 711.7 JOINTS - REFER TO 709.7 713.0 FLOOR/CEILING AND ROOF/CEILING ASSEMBLIES 713.2 CURTAIN WALL GAP 713.4 PENETRATIONS - REFERS TO 714 713.5 JOINTS - REFERS TO 709.7 714.0 PENETRATIONS - ALL REQUIREMENTS (GENERAL) 714.1 THROUGH 714.1.6.2 WALL ASSEMBLIES 714.2 THROUGH 714.2.6.5 FLOOR/CEILING AND ROOF/CEILING ASSEMBLIES 714.3 THROUGH 714.3.2 NONRATED ASSEMBLIES 721.0 FIREBLOCKING AND DRAFTSTOPPING	6-2.3.2.4 PENETRATIONS AND MISC. OPENINGS &FIRE BARRIERS 6.2.4.2, EXCEPTION 5 OPENINGS (EXPANSION OR SEISMIC JOINTS) IN FLOORS APPENDIX A-6-2.4.2 6-3.6.1 PENETRATIONS AND MISC. OPENINGS IN FLOORS AND SMOKE BARRIERS NFPA #221 FIRE WALLS AND BARRIERS **NFPA Code 70 NEC National Electric Code** 300-21 FIRESTOPPING **CABO One and Two Family Dwelling Code (1995 Edition)** 602.7 FIRESTOPPING (FIREBLOCKING IN OTHER MODEL CODES)

5. Installation Techniques

Shown are examples of approved applications of CP 25WB+ Caulk. Additional drawings and details are available through your Authorized 3M Fire Protection Products Distributor.

Installation Notes:

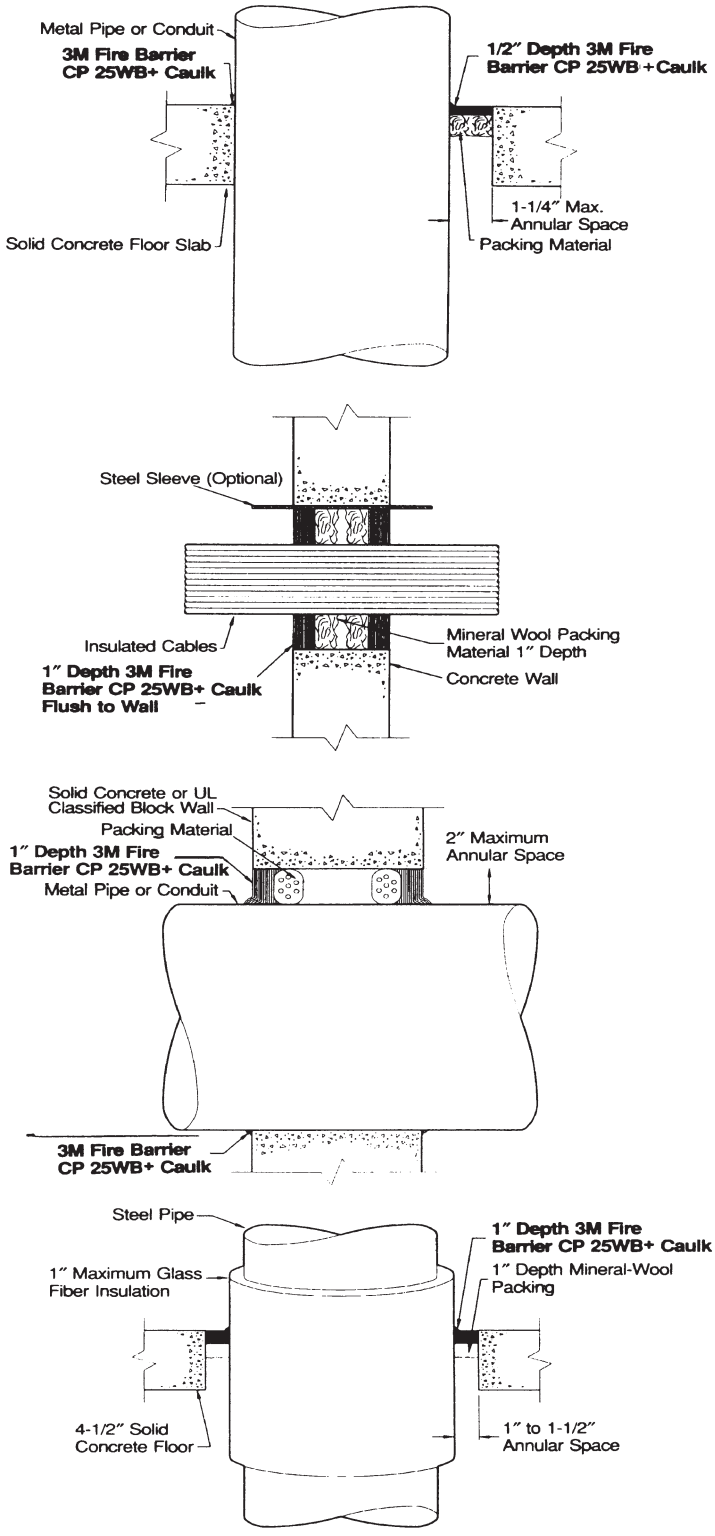
1. Metal Pipe/Conduit applications through nominal 12 in. (304,8 mm) outside diameter.
   - Installed depth of CP 25WB+ Caulk depends on annular space.
   - When the annular space is less than 1-1/4 in. (31,8 mm), a 1/2 in. (12,7 mm) minimum depth of CP 25WB+ Caulk is required.
   - When the annular space is greater than 1-1/4 in. (31,8 mm), a 1 in. (25,4 mm) minimum depth of CP 25WB+ Caulk is required.
   - Common building materials, such as backer rod may be used for metal pipe applications.

2. Metal Pipe applications larger than nominal 12 in. (304,8 mm) outside diameter.
   - All cases require a 1 in. (25,4mm) minimum depth of CP 25WB+ Caulk.

3. Insulated Cable Applications.
   - All cases require a 1 in. (25,4mm) minimum depth of CP 25WB+ Caulk.
   - All cases require mineral wool (safing) for packing.

4. Fiberglass Insulated Pipe Applications.
   - 1 in. (25,4 mm) of fiberglass insulation on up to a nominal 12 in. (304,8 mm) of metal pipe may be firestopped with a 1 in. (25,4 mm) depth of CP 25WB+ Caulk.
   - 1 in. (25,4 mm) depth of mineral wool packing required.

Typical Penetration Firestops For Metal Pipe/Conduit and Insulated Cable Through Fire Rated Construction



6. Maintenance

The CP 25WB+ Caulk is stable under normal storage conditions and has a one year shelf life. Normal stock and stock rotation are recommended.

Recommended
Store between 40°F (4°C)-90°F (32°C) for maximum shelf life. Keep from freezing.

7. Availability

3M Brand Fire Barrier CP 25WB+ Caulk is available from Authorized 3M Fire Protection Products Distributors. It is available in Standard 10.1 fl. oz. cartridge, 20 oz. sausage, 27.0 oz. cartridge, 2 gallon pail and 5 gallon pail.

Warranty and Limited Remedy. This product will be free from defects in material and manufacture for a period of ninety (90) days from date of purchase. **3M MAKES NO OTHER WARRANTIES INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.** User is responsible for determining whether the 3M product is fit for a particular purpose and suitable for user's method of application. If this 3M product is proved to be defective within the warranty period stated above, your exclusive remedy and 3M's sole obligation shall be, at 3M's option, to replace or repair the 3M product or refund the purchase price of the 3M product.

Limitation of Liability. Except where prohibited by law, 3M will not be liable for any loss or damages arising from the use of this 3M product, whether direct, indirect, special, incidental or consequential, regardless of the legal theory asserted, including warranty, contract, negligence or strict liability.

3M
Building Safety Solutions Department
3M Center 223-2S-24
St. Paul, MN 55144-1000
Phone 800-328-1687
Fax 888-362-2737
www.3m.com/firestop

Recycled paper
40% pre-consumer
10% post-consumer

Bolger 5050680
98-0400-5012-6

DIVISION 02 – SITE CONSTRUCTION

TABLE OF CONTENTS

- SECTION 02 3100 -

SUBSURFACE INVESTIGATION

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 SECTION INCLUDED

A. All labor, materials, tools, equipment, transportation, and temporary construction of any nature necessary for a complete operational installation of all work shown on the Plans and/or specified hereinafter.

1.3 RELATED SECTIONS

A. Consult all other Specification sections, determine the extent and character of related work, and properly coordinate work specified herein with that specified elsewhere to produce a complete operational installation.

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. D1556: Density of Soil in Place by Sand Cone Method.
   2. D1557: Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in (457-mm) Drop.
   3. D2922: Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depths).

B. California Department of Transportation (CDT):
   1. Standard Test Methods: No. 216, 231 and 301.

C. Geotechnical Report:
   1. A geotechnical report is available and is titled “Preliminary Geotechnical Investigation: Improvements at College of San Mateo, San Mateo, California” prepared by TRC, dated June 8, 2007.

1.5 SOILS INVESTIGATION INTERPRETATION

A. Soils investigation data is provided by the Owner for information and the convenience of bidders. Bidders are urged to examine soils investigation data and to make their own investigation of the site before bidding. The Owner and Engineer disclaim any responsibility for the accuracy, true location and extent of the soils investigations that have been prepared by others. They further disclaim responsibility for interpretation of that data by bidders as in projecting soil-bearing values, rock or soil profiles, soil stability and the presence, level and extent of underground water. Soils investigation data is not part of the Contract Documents.

1.6 SOILS TESTING DURING CONSTRUCTION

A. Usual Services by Soils Engineer Retained by the Owner:

1. Site Grading and Excavation: Selection of fill materials for reuse on Project shall be based on testing by the Soils Engineer. Bottoms of excavations shall be checked and tested for suitability.
2. Footings, Piers and Caissons: Bottom of excavations shall be checked and tested for soil suitability. The Architect and Structural Engineer shall be advised on all revisions necessary to meet Specifications for foundation excavations.
3. Backfill Operations: Soils Engineer shall test import and native materials for suitability and for compaction.
4. Utility Trenching and Other Miscellaneous Operations: Soils Engineer shall test materials and compaction.
5. Roads and Parking Areas: Soils Engineer shall test materials and compaction of sub-grade, sub-base, base and surface courses.

B. Soils Testing Services for Which the Contractor Must Pay:

1. For retesting and inspection of rejected work, and in cases where the Contractor does not expedite the soils work in accordance with the Specifications, the Engineer shall prepare a credit change order to the Contract to reimburse the Owner for extra services rendered by the Soils Engineer. The Owner will require the Soils Engineer to invoice separately for the extra work, which will establish the amount of the change order. The Owner will, upon execution of the credit change order, pay the Soils Engineer directly for its extra work.

1.7 ARCHEOLOGICAL SITES

A. General:

1. Any grading and/or excavation work shall be monitored by an archaeologist (or suitable representative) designated by the property owner to inspect for the presence of prehistoric cultural resources.
2. Should evidence of prehistoric cultural resources be discovered during monitoring, work in the immediate area shall be stopped to allow adequate time for evaluation and mitigation; the material shall be evaluated; and if significant, a mitigation program including collection and analysis of the materials prior to resumption of grading, preparation of a report, and curation of the materials at a recognized storage facility shall be developed and implemented under the direction of the property owner and the Director of Community Development.
3. Interruptions to Contractor's construction operations resulting in monetary loss will be handled by an appropriate change order.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 TEST METHODS

A. Relative Compaction: In-place compaction testing shall be in accordance with one or more of the following methods (at the Soils Engineer's option): ASTM D1556, or ASTM D2922. Laboratory testing shall be in accordance with one or more of the following methods (at the Soils Engineer's option): California Test Method No. 216 or ASTM D1557.

B. Resistance Value (R Value): The R Value of soil materials shall be as determined by California Test Method No. 301.

- END OF SECTION -

- SECTION 02 4113 -

SITE DEMOLITION

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. Removing above-grade site improvements within limits indicated.

B. Disconnecting, capping or sealing, and abandoning site utilities in place.

C. Disconnecting, capping or sealing, and removing site utilities.

D. Disposing of objectionable material.

1.3 RELATED SECTIONS

A. Section 31 11 00 – Site Preparation.

B. Section 31 23 33 – Trenching, Backfilling and Compacting.

1.4 DEFINITIONS

A. ANSI: American National Standards Institute.

B. CAL-OSHA: California Occupational Safety and Health Administration.

1.5 PROJECT CONDITIONS

A. District assumes no responsibility for actual condition of the site to be altered.
   1. Conditions existing at time of inspection for bidding purpose will be maintained by District as far as practical.

B. Disposal of Existing Improvements:
   1. All materials removed shall become the property of the Contractor; dispose of these materials outside the project site.

a. Do not dispose of removed materials to the general public by sale, gift or in any other manner at the project site.

b. These provisions shall not be construed as limiting or prohibiting sale or disposal of such materials at the Site to duly licensed Contractors or material suppliers, provided materials are removed from construction site by the Contractor.

2. All removal of debris from the site, including removal of inventory to site of storage, is part of this Contract and shall be done by Contractor's employees and no others.

C. Salvage:

1. Recycle AC pavement and Class II AB where practical.
2. Recycle concrete where practical.
3. Items indicated to be salvaged shall be removed carefully, cleaned, and returned to the District. Coordinate with the Project Manager.

D. Protection:

1. Erect and maintain temporary bracing, shoring, lights, barricades, except construction barricades for subsequent new construction, warning signs, and guards necessary to protect public, the District's employees, adjacent improvements to remain, and adjoining property from damage, all in accordance with applicable regulations.
2. Wet down areas affected by this work as required to prevent dust and dirt from rising.

E. Scheduling:

1. Coordinate with the Project Manager in scheduling noisy or dirty work.
2. The Project Manager will supply a schedule of days on which no construction will be allowed.
3. Contractor shall take College schedule into consideration during construction.
4. Coordinate and schedule temporary water shut-downs and temporary water service with the Project Manager, Facilities, and the Water Department, and the Fire Department.

F. Traffic Circulations: Ensure minimum interference with roads, streets, driveways, sidewalks, and adjacent facilities.

1. Minimize obstruction to thoroughfares by first obtaining the required approval or permission of the responsible jurisdiction.
2. Where closing of a vehicular traffic circulation route is necessary, provide adequate directional signs to minimize the potential for confusion. Provide access at all times for emergency vehicles.

G. Safety:

1. The College of San Mateo campus has a history of serpentine rock. The Contractor shall take all necessary precautions to eliminate the exposure of workers, students, staff, and the public to asbestos fibers, including but not limited to: dust control measures and measures included in Sections 93106 and 93105 of California Code of Regulations, Title 17.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Backfill excavations resulting from demolition operations with on-site or import materials conforming to structural backfill defined in Section 31 20 00 - Earth Moving (Earthwork).

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points during construction.

B. Protect existing site improvements to remain during construction.

3.2 RESTORATION

A. Restore damaged improvements to their original condition, as acceptable to the Owner.

3.3 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed or abandoned.

B. Arrange to shut off indicated utilities with utility companies or verify that utilities have been shut off.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless authorized in writing by the Owner, and then only after arranging to provide temporary utility services according to requirements indicated.

D. Coordinate utility interruptions with utility company affected.

E. Do not proceed with utility interruptions without the permission of the Owner and utility company affected. Notify Owner and utility company affected two working days prior to utility interruptions.

F. Excavate and remove underground utilities that are indicated to be removed.

G. Securely close ends of abandoned piping with tight fitting plug or wall of concrete minimum 6-inches thick.

3.4 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, and gutters, as indicated. Where concrete slabs, curb, gutter and asphalt pavements are designated to be removed, remove bases and subbase to surface of underlying, undisturbed soil.

C. Unless the existing full-depth joints coincide with line of pavement demolition, neatly saw-cut to full depth the length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

D. Remove driveways, curbs, gutters and sidewalks by saw cutting to full depth. If saw cut falls within 30-inches of a construction joint, expansions joint, score mark or edge, remove material to joint, mark or edge.

3.5 BACKFILL

A. Place and compact material in excavations and depressions remaining after site clearing in conformance with Section 31 23 33 – Trenching, Backfilling and Compacting.

3.6 DISPOSAL

A. Remove surplus obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off the Owner's property.

B. Burning of demolished materials is prohibited.

3.7 FIELD QUALITY CONTROL

A. The Project Manager will accompany the Contractor before and after performance of work to observe physical condition of existing structures or improvements involved.

- END OF SECTION -

DIVISION 03 – CONCRETE

TABLE OF CONTENTS

- SECTION 03 1000 -

CONCRETE FORMING

PART 1 - GENERAL

1.1 RELATED INFORMATION AND REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary and Division 1 Specification Sections, specific Specification Sections listed below, and all other Specification Sections apply to this Section.

1. Concrete Reinforcing
2. Cast-In-Place Concrete
3. Concrete Curing
4. Concrete Finishing

1.2 SECTION INCLUDES

A. Construction: Provide material, labor, equipment, mock-ups, services, tests and inspections, necessary for the installation, shoring, bracing, and removal of concrete formwork.

B. Engineering: Provide engineering services for the design and implementation of concrete formwork, including required shoring and bracing.

1.3 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.

1. CBC – 2007 California Building Code.
2. AAMA - American Architectural Manufacturer's Association, product specifications referenced herein.
3. ACI - American Concrete Institute,
   a. ACI 117, "Standard Specifications for Tolerances for Concrete Construction and Materials".
   b. ACI 301, "Specifications for Structural Concrete".
   c. ACI 347, "Guide to Formwork for Concrete".
4. ASTM - American Society for Testing and Materials, designations referenced herein.
5. State of California,
   a. Construction Safety Orders (CAL/OSHA).
   b. Code of Regulations (CCR).

1.4 SUBMITTALS

A. General: Submittals shall be sent to the Architect, or District's Testing Agency, or both, as required herein for review prior to commencing the work. Review of submittals covers the general character of the details and to verify compliance with the performance requirements. Review does not cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

1.5 CONTRACTOR'S ENGINEERING SERVICES

A. General: Where engineering services are required herein, the Contractor shall retain either a Civil or Structural Engineer registered in the State of California, referred to herein as the Contractor's Engineer.

1. Documents prepared by the Contractor's Engineer shall be stamped and signed.

B. Formwork: The Contractor's Engineer shall perform or supervise the design, inspection, and creation of scheduled procedures for concrete formwork, including, but not limited to, shoring, bracing, re-shoring, and form removal in accordance with ACI 347.

PART 2 - PRODUCTS

2.1 CONCRETE FORM MATERIALS

A. Rough Form Finish (Concealed Surfaces): Plywood, lumber, metal, or other material of sufficient strength and stiffness to properly hold concrete in place. Provide lumber dressed on at least two edges and one side for tight fit and to prevent leakage of concrete.

B. Smooth Form Finish (Exposed Surfaces): Form-facing panels that will provide continuous, straight, uniform textured, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize the number of joints.

1. Wood Forms: Unless otherwise specified, wood forms shall be Douglas fir plywood, 5 ply, 3/4 inch, B-B Plyform, Class I, exterior type, edges sealed. Mill-oiled plywood shall not be permitted. Plywood sheets shall bear APA trademark stamp indicating plywood grade and thickness.
2. Steel and Fiberglass Forms: Suitable for concrete construction.

C. Round Column Forms: Metal, fiberglass, or spiral wound fiber tubes suitable for concrete construction.

D. Lost Forms:

1. Expanded polystyrene manufactured in accordance with ASTM C 578.
2. Metal or cardboard specifically designed for use as concrete formwork.
3. Expanded metal forms: Amico's "Stay-form", or equal.
4. Wood shall not be used as lost forms without written permission from the Architect.

E. Chamfer, drip, groove, and reveal strips: FRP, PVC, or smooth milled wood, fully sealed on all sides with two coats of form sealer.

F. Form Ties: Factory fabricated, adjustable length removable or snap-off metal ties with 1" maximum diameter plastic cones inserts designed to prevent form movement and prevent concrete spalling upon removal. No part of form ties left in concrete members shall be closer than 1½" to concrete surfaces. Form ties used for structural members located below grade shall not be hollow and shall provide a water-stop washer placed at the center of the tie.

G. Form Spreaders: Metal with plastic-covered tips at each end.

H. Form Joint Caulking: Closed-cell PVC foam tape with pressure-sensitive adhesive on one side.

I. Form Joint Sealer: Silicone or urethane sealant.

J. Form Release Agent: Colorless, non-staining, non-toxic agent intended for this use that shall not impair the bonding of paint or other coatings. Manufactured by Noxcrete or equal.

K. Form Spreaders: Metal with plastic-covered tips at each end.

L. Form Joint Caulking: Compressible Tape meeting AAMA 810.1-92, Type I requirements.

M. Form Joint Sealer: Sealant for form joints shall conform to ASTM C 920, Type a, Grade NS, or ASTM C 834.

N. Form Sealer: Chemstop Manufacturing Company's "Chemstop", Burke's "form Sealer" W.R. Grace Company's "Formfilm", or equal.

O. Form Release Agent: Colorless, non-staining, non-toxic agent intended for this use that shall not impair the bonding of paint or other coatings. Manufactured by Noxcrete or equal.

PART 3 - EXECUTION

3.1 PROTECTION OF MATERIALS

A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

3.2 TOLERANCES

A. Formwork for standard and architectural concrete shall be constructed such that the shapes, sizes, lines, and dimensions of cast-in-place concrete shown on the Drawings conform to the tolerances listed in the Section entitled "Cast-In-Place Concrete".

B. Offsets between adjacent formwork facing materials for rough finish, concealed surface concrete formwork shall conform to ACI 117 Class C requirements.

C. Offsets between adjacent formwork facing materials for smooth finish, exposed surface concrete formwork shall conform to ACI 117 Class B requirements.

3.3 COORDINATION

A. The Contractor shall coordinate, locate, and provide sleeves and penetrations in formwork for electrical, plumbing, heating, ventilating, and other work.

B. The Contractor shall locate, coordinate, provide, and verify openings, offsets, reveals, recesses, nailing blocks, channel cases, anchors, ties, and inserts in the formwork before concrete is placed.

3.4 CONCRETE FORMWORK CONSTRUCTION

A. The construction and maintenance of concrete formwork shall be as directed by the Contractor's Engineer and in accordance with ACI 347.

B. Formwork shall be new at the start of the job. Forms may be reused, provided they are thoroughly cleaned of dirt, mortar, oil, rust, and foreign materials, and are undamaged at edges and contact faces. Reuse of forms shall be subject to approval by the Architect.

C. Formwork shall not stain the concrete.

D. Oiling of forms shall not be permitted.

E. The arrangement of formwork shall be uniform and neat.

F. Formwork shall be built to support the weight of concrete within deformation limits, formed to the shapes, sizes, lines, and dimensions shown on the Drawings. Footings and grade beams do not require formwork unless otherwise indicated.

G. Form ties shall provide accurate spreading and positive tying. Layout of ties shall be uniform, aligned, and symmetrical. Wire ties shall not be used.

H. Provide chamfer strips at all exposed, protruding concrete corners, unless otherwise noted on Drawings.

I. Form horizontal joints shall be level and continuous. Formwork vertical joints shall be plumb.

J. Seal form joints with foam tape or form joint sealer. Forms shall be sealed sufficiently tight to prevent leakage of mortar.

K. Provisions shall be made for openings, offsets, inserts, embedments, blocking, and other features of the work as shown or indicated. Penetrations, notches, and blockouts in concrete elements not shown on the Drawings shall not be installed without written approval from the Architect.

L. Attach chamfers, drip, groove, and reveal strips securely to prevent displacement and dislodgement during concrete placement and form removal.

M. Provide temporary openings at the base of wall and column forms to facilitate inspection of concrete reinforcement and to allow cleaning of forms. Do not locate temporary openings at exposed concrete surfaces.

N. Apply form release agent to form surfaces prior to placement of reinforcement.

O. Immediately prior to concrete placement, clean forms, wet forms, remove freestanding water, and seal temporary openings.

3.5 FORMWORK REMOVAL

A. Formwork shall be removed according to the schedule and sequence prepared by the Contractor's Engineer and in accordance with ACI 347.

1. Formwork shall not be removed until the concrete has hardened sufficiently to permit formwork removal with safety, and until the concrete members have attained sufficient strength and stiffness to safely support the imposed loads. The minimum times for removal of formwork after concrete has been placed shall be as shown below.
   a. Footings (where required): 2 days
   b. Columns: 3 days
   c. Walls and Pilasters: 3 days; 7 days for Architectural Concrete
   d. Side Forms for Joists, Beams, and Girders: 3 days
   e. Soffit Forms for Joists, Beams, Girders, and One-Way Slabs: 7 days for form facing material; shore until concrete achieves design compressive strength, 7 days minimum.
   f. Soffit Forms for Two-Way Slabs: 7 days for form facing material; shore until concrete achieves design compressive strength, 21 days minimum.
   g. Soffit Forms for Post-Tensioned Beams, Girders, and Slabs: As soon as full post-tensioning force has been applied.
2. Formwork removal shall be coordinated with the requirements in the section titled "Concrete Curing".

B. Formwork shall be removed without damaging the concrete exposed surfaces, chamfers, and inserts.

3.6 RESHORING

A. Reshoring shall be as directed by the Contractor's Engineer and in accordance with ACI 347.

B. Reshoring shall be designed and implemented in a manner that does not subject the concrete to excessive loads. The minimum time to begin reshoring is 14 days after the concrete has been placed, and not until the full compressive design strength of the concrete has been achieved.

1. Reshore locations shall not alter design stress patterns. Reshoring shall equal at least 50 percent of in-place shores and shall be placed immediately after shore removal.
2. Previously placed concrete elements shall not support reshoring until their full design compressive strength has been achieved and not until at least 14 days after casting.

3.7 CONSTRUCTION LOADS

A. Construction loads on concrete elements supported by concrete formwork shall be as directed by the Contractor's Engineer. Construction loads shall not exceed design loads indicated on the Drawings.

3.8 CORRECTION OF DEFECTIVE WORK

A. Correction of defective work shall be the responsibility of the Contractor.

B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Architect.

C. Corrected work shall conform to the requirements of the Contract Documents.

D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Architect for review. The submittal shall include a description of the defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor's proposed corrections.

E. Correction of defective work shall not commence until the Architect has reviewed and accepted the submittal.

F. Correction of defective work shall be inspected by the District's Testing Agency.

3.9 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

- END OF SECTION -

- SECTION 03 2000 -

CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED INFORMATION AND REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, specific Specification Sections listed below, and all other Specification Sections apply to this Section.

1. Concrete Forming
2. Cast-In-Place Concrete
3. Concrete Curing
4. Concrete Finishing

1.2 SECTION INCLUDES

A. Construction: Provide material, labor, equipment, services, mock-ups, tests and inspections necessary for the installation of concrete reinforcement.

1.3 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.

1. CBC – 2007 California Building Code.
2. ACI - American Concrete Institute,
   a. ACI 117, “Standard Specifications for Tolerances for Concrete Construction and Materials”.
   b. ACI 301, “Specification for Structural Concrete for Buildings”.
   c. ACI 315, “Details and Detailing of Concrete Reinforcement”.
3. ASTM - American Society for Testing and Materials, designations referenced herein.
4. AWS - American Welding Society,
   a. AWS D1.1, “Structural Welding Code - Steel”.
   b. AWS D1.4, “Structural Welding Code - Reinforcing Steel”.
5. CRSI - Concrete Reinforcing Steel Institute,
   a. CRSI MSP-1, “Manual of Standard Practice”.
   b. CRSI, “Placing Reinforcing Bars”.
6. ICC-ES - International Code Council Evaluation Services, Evaluation Reports referenced herein.

1.4 SUBMITTALS

A. General: Submittals shall be sent to the Architect, or District's Testing Agency, or both, as required herein for review prior to commencing the work. Review of submittals covers the general character of the details and to verify compliance with the performance requirements. Review does not cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

B. Shop Drawings: The Contractor shall submit concrete reinforcement shop drawings prepared in accordance with ACI 315 to the Architect for review. Fabrication or delivery of material to the building site shall not begin until the Architect's review is complete.

1. Shop drawings shall include plan, elevation, and detail views with project grids accurately indicating bar material type, size, lengths, locations, bends, lap splice lengths and locations, welded splice locations, mechanical coupler locations, and headed bar locations.
2. Layering and sequencing information for intersections shall be identified.
3. Shop drawings shall not include copies of Contract Document details. References to Contract Document details in lieu of details prepared as part of placing drawing submittals will not be accepted.
4. Shop drawings shall list the structural materials included in the submittal. Reinforcement shown on placing drawings illustrating sequencing, layering, or intersections, but not included in the placing drawing bar lists, shall be identified as "previously submitted" or "to be submitted".

C. Mill Certificates: The Contractor shall submit mill certificates in accordance with ASTM designations referenced herein for each heat of reinforcement, mechanical couplers, and headed bars to the District's Testing Agency for review.

D. Welding Documents: The Contractor shall submit Welding Procedure Specifications (WPSs), Procedure Qualification Records (PQRs), and Welder Qualification Test Records (WQTRs) prepared in accordance with AWS D1.4 for each type of weld and position to be performed to the District's Testing Agency for review.

E. Manufacturer's Data: The Contractor shall submit manufacturer ICC-ES reports for mechanical couplers and headed bars to the Architect for review.

F. Samples: The Contractor shall submit samples of mechanical couplers and headed bars to the District's Testing Agency for testing as required herein and on the Drawings.

G. Contractor's quality control test reports: The Contractor shall submit quality control test reports to the Architect and District's Testing Agency for review.

1.5 TESTS AND INSPECTIONS

A. Notification:

1. The Contractor shall notify the District's Testing Agency of work to be tested and inspected. Notification shall be sufficiently in advance to allow scheduling of tests and inspections, but not less than 24 hours.
2. The Contractor shall immediately notify the Architect if the District's Testing Agency indicates that quality assurance tests and inspection requirements have not been met.

B. District's Quality Assurance Tests and Inspections:

1. General: Quality assurance tests and inspections shall be the responsibility of the District. The District shall retain a testing agency, referred to herein as the District's Testing Agency, who shall perform the required tests and inspections, prepare written summary reports of tests and inspections, and review submittals.
2. The District's Testing Agency shall inspect material, size, spacing, arrangement, placement, and cover of reinforcement.
3. The District's Testing Agency shall verify heat number of bundles with mill analysis certificates and shall perform tension and bend tests on reinforcement bars in accordance with ASTM A 370, "Standard Test Methods and Definitions for Mechanical Testing of Steel Products" as indicated below. Test reports shall be reviewed before placement of reinforcement.
    a. Where samples are taken from bundles as delivered from the mill, with the bundles identified as to heat number and provided the mill analyses accompany the material, one tensile and one bend test shall be conducted on the material for each 10 tons or fraction thereof of each size of reinforcement bar.
    b. Where positive identification of heat numbers cannot be made or where random samples are taken, one tensile and one bend test shall be conducted on the material for each 2 ½ tons or fraction thereof of each size of reinforcement bar.
4. The District's Testing Agency shall conduct tension load tests on Type II and Type III mechanical couplers at the frequency indicated on the Drawings, but not less than 1 test for each 100 mechanical couplers or fraction thereof. Perform tests on no less than 2 couplers of each type. Test specimens shall be selected at random. Tension tests shall be conducted to failure of the coupler or rupture of the bar in accordance with ASTM A 370. Alternatively, where the supplier conducts tension load tests in conformance with ASTM A 370 at a frequency that meets or exceeds that stated above, the District's Testing Agency may observe tension load tests performed by the supplier in lieu of performing tension load tests.
5. The District's Testing Agency shall verify compliance with the manufacturer's recommended installation procedures on in-place mechanical couplers, and headed bars that utilize threaded connections, at the frequency indicated on the Drawings, but not less than 10%.
6. The District's Testing Agency shall observe tension tests performed on Type II and Type III headed reinforcement at the frequency indicated on the Drawings, but not less than 1 test for each 100 headed bars or fraction thereof. Perform tests on no less than 2 headed bars. Test specimens shall be selected at random. Tension tests shall be conducted to failure of the head or rupture of the bar in accordance with ASTM A 970.
7. Welding of reinforcement shall be inspected by the District's Testing Agency in accordance with AWS D1.4, and, where indicated, AWS D1.1.
    a. Review the WPSs, PQRs, WQTRs, and suitability of welding equipment.
    b. Inspect welding work, including surface preparation, preheat, welder technique and performance, equipment, weld lengths, and weld sizes for conformance with the WPSs.
    c. Perform visual inspection of fillet, flare-v-groove, and flare-bevel-groove welds of reinforcement bars to structural steel.
    d. Perform visual inspection and nondestructive testing of complete joint penetration (CJP) groove welds. Nondestructive testing shall be magnetic particle testing performed in accordance with ASTM E 709.

e. For reinforcement bars welded to structural steel, verify surface preparation, required preheat, and filler metal type for the structural steel conforms to AWS D1.1 requirements.

C. Contractor's Quality Control Tests and Inspections:
1. General:
a. Quality control tests and inspections shall be the responsibility of the Contractor.
b. Where required herein, the Contractor shall demonstrate that quality control conforms to the requirements of the Contract Documents.
c. Quality Control Test and Inspection Reports shall be prepared and submitted for review.
2. Tension tests of reinforcement bar not accompanied by certified mill analysis reports: The Contractor shall conduct one tension test and one bend test in accordance with ASTM A 370 for each 2 ½ tons or fraction thereof of each material type and size of reinforcement bar not accompanied by certified mill analysis reports. Test reports shall be reviewed by the District's Testing Agency before placement of reinforcement.

PART 2 - PRODUCTS

2.1 REINFORCEMENT MATERIALS

A. Reinforcement:
1. Typical Bars: Deformed, material type as indicated on the Drawings.
a. ASTM A 706, Grade 60.
b. ASTM A 615, Grade 60.
2. Special Bars: Bars end-fitted with friction-welded components shall be ASTM A 706, deformed.
3. Bars Welded to Structural Steel: ASTM A 706, deformed.

B. Deformed Bar Anchors (DBA): See Section titled "Structural Steel".

C. Spiral Wire Reinforcement: ASTM A 82.

D. Welded Wire Fabric: Sheets conforming to ASTM A 185.

2.2 TIE WIRE AND BAR SUPPORTS

A. Tie Wire: #16 gauge (AWG) or heavier, black annealed wire.

B. Tie Wire for Architectural Concrete: #16 gauge (AWG) or heavier, ASTM A 492 stainless steel.

C. Bar supports in shall be provided as follows.
1. Typical Supports in Contact with Formwork, Unless Otherwise Noted: CRSI Class 2 - Type A, or all-plastic supports.
2. Supports in Contact with Ground: Precast concrete blocks ("dobies") with embedded wires.

3. Supports Not in Contact with Formwork or Ground: Lengths of reinforcement bar, or metal or plastic spreaders and separator specifically intended for support of concrete reinforcement.
4. Supports for Architectural Concrete: CRSI Class I plastic-protected stainless steel.

2.3 MECHANICAL COUPLERS AND HEADED BARS

A. Mechanical Couplers: Standard, transition, position, and half-couplers (form savers) for reinforcement bars shall be as follows. Swaged and wedged couplers shall not be used. Type II or Type III couplers may be used in lieu of Type I at the Contractor's option, provided that these couplers can be dimensionally accommodated in the reinforcing cage.

1. Type I couplers shall meet the requirements of the CBC.
   a. BarSplice Products' "ZAP Screwlok 'SL' series".
   b. Dayton/Richmond's "DB-SAE series coupler".
   c. Erico Lenton's "A2 series coupler".
   d. BarSplice Products' "Standard Barsplicer System" (A 615 reinforcement only)
   e. Dayton/Richmond's "Barlock S/CA-series coupler" (A 615 reinforcement only).
2. Type II couplers shall meet the requirements of the CBC. Couplers shown on the drawings shall be Type II, unless otherwise shown or indicated.
   a. BarSplice Products' "ZAP Screwlok" series.
   b. Erico Lenton's "A12 & P14L" series.
   c. Dayton/Richmond's "Barlock L-series" (A 615 reinforcement only).
   d. Dayton/Richmond's "US/MC-SAE" series (A 615 reinforcement only).
3. Type III couplers shall meet the requirements of the CBC for Type II couplers. In addition, Type III couplers shall be capable of developing the full rupture strength of the reinforcement bar without failure of the coupler following a minimum ductile elongation of 10% of the sample length, or 175% of the specified reinforcement yield strength, whichever is greater. Type III couplers shall conform to the dimensional tolerances shown on the Drawings such that special ties or hoops are not required at the coupler, required concrete cover requirements are not violated, and location of longitudinal bars is not altered.
   a. Headed Reinforcement Corporation's "HRC 400" (A 706 reinforcement only) or "HRC 500" series.
   b. Erico Lenton's "A12 Plus & P14 Plus" series, or approved equal.

B. Headed Bars:

1. Type I headed bars shall be used where indicated on the drawings and in lieu of hooked bar ends at the Contractor's option except where Type II or Type III headed bars are indicated. Terminations shall be capable of developing the specified yield strength of the reinforcing bar.
   a. Erico Lenton's "Terminator D6" series headed bars.
   b. BarSplice Products' "DoughNUT" series headed bars (A 615 reinforcement only).
2. Type II headed bars shall be used where indicated on the drawings. Terminations shall be capable of developing 160% of the specified yield strength of the reinforcing bar. Headed bars shown on the drawings shall be Type II, unless otherwise shown or indicated.
   a. Dayton/Richmond's "D-158" series headed bars.

b. Erico Lenton's "Terminator D16" series headed bars.

3. Type III headed bars shall be used where indicated on the drawings. Terminations shall be capable of developing the full rupture strength of the reinforcement outside the termination following a minimum ductile elongation of 10% of the sample length, or 175% of the specified reinforcement yield strength, whichever is greater. Type III headed bars shall conform to the dimensional tolerances shown on the Drawings such that the required concrete cover requirements are not violated.
   a. Headed Reinforcement Corporation's "HRC 100" and "HRC 200" series T-Headed Bars (A 706 reinforcement only).
   b. Erico Lenton's "Terminator D16 Plus" series headed bars.

2.4 WELDING ACCESSORIES

A. Welding Filler Metals: Use AWS D1.4 matching type filler metals.

PART 3 - EXECUTION

3.1 PROTECTION OF MATERIALS

A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

3.2 COORDINATION

A. Coordinate locations and sizes of penetrations and openings in concrete members and verify conformance to structural requirement shown on the Drawings. Additional reinforcement at penetration and opening locations shall be as indicated on the Drawings.

3.3 FABRICATION

A. Tolerances for reinforcement fabrication shall conform to the requirements of ACI 315.

B. Reinforcement shall be shop fabricated to the lengths and bends shown on the Drawings, by experienced shops using methods that do not damage the reinforcement.

C. Bars shall be cold bent.

D. Concrete cover, measured to edge of reinforcement, mechanical couplers, and headed bars, shall be as shown and scheduled on the Drawings.

E. Bars shall be placed, spaced, and aligned as indicated on the Drawings.

F. Stagger splices of adjacent bars, unless otherwise shown on the Drawings.

G. Where the Contractor utilizes reinforcement splices not shown on the Drawings, the splice locations shall be included in the reinforcement placing drawing submittals for review by the Architect. Splices of reinforcement shall not be made at points of maximum stress.

H. Lap splices and dowel lengths shall be as indicated on the Drawings, but not less than 40 bar diameters, or 24 inches, whichever is more.

I. Locate mechanical couplers and headed bars as shown on the Drawings. Where the Contractor utilizes mechanical couplers not shown on the Drawings, the coupler types and locations shall be included in the reinforcement placing drawing submittals for review by the Architect.

J. Stagger mechanical coupler locations at adjacent reinforcement bars as indicated on the Drawings, but not less than 24 inches.

K. Reinforcement bundles shall be tagged with suitable identification to facilitate sorting and placing.

3.4 PLACING

A. Tolerances for placement of reinforcement shall conform to ACI 117.

B. Prior to placing reinforcement, the contractor shall clean reinforcement free of scale, dirt, grease, or other foreign substances detrimental to bonding. Maintain cleanliness of reinforcement until it has been completely encased in concrete.

C. Placement of reinforcement shall be in accordance with CRSI - Placing Reinforcing Bars.

D. Concrete reinforcement shall be supported in conformance with the CRSI Manual of Standard Practice, and shall not be unsupported for lengths exceeding 4’-0”. Use spreaders between curtains of vertical reinforcement to maintain bar alignment in the forms.

E. Reinforcement shall be placed to meet the concrete cover, bar spacing, and bar alignment requirements indicated on the Drawings.

F. Tie intersecting reinforcement bars with tie wire in accordance with the CRSI - Placing Reinforcing Bars to prevent displacement during casting of concrete. Tack welding of intersecting bars shall not be allowed.

3.5 MECHANICAL COUPLERS AND HEADED BARS

A. Threaded mechanical couplers and headed bars shall be tightened with a torque wrench according to the manufacturer’s recommendations.

3.6 WELDING

A. Welding of reinforcement bars to structural steel shall be in accordance the requirements of AWS D1.4 for the reinforcement bar and AWS D1.1 for the structural steel surface preparation, filler metal type, and preheat.

B. Welders shall be qualified for processes, positions, and weld thicknesses to be used by that welder.

C. Shop welders, field welders, and welding foremen shall possess a copy of the approved WPSs.

3.7 REQUIREMENTS FOR ARCHITECTURAL CONCRETE

A. At exposed faces of architectural concrete, bar chairs, supports, bolsters, and other devices shall not be attached to the form face material.

B. Turn tie wires after cutting toward the inside of concrete members and bend in such a manner that concrete placement will not displace the wires toward exposed concrete surfaces.

C. Welding of reinforcement shall be performed prior to placing reinforcement in formwork.

3.8 FIELD MODIFICATIONS

A. Reinforcement shall not be field bent except where specifically indicated as such on the Drawings, or with written permission from the Architect. Bars kinked or bent during construction shall be considered defective work.

3.9 CORRECTION OF DEFECTIVE WORK

A. Correction of defective work shall be the responsibility of the Contractor.

B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Architect.

C. Corrected work shall conform to the requirements of the Contract Documents.

D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Architect for review. The submittal shall include a description of the defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor's proposed corrections.

E. Correction of defective work shall not commence until the Architect has reviewed and accepted the submittal.

F. Correction of defective work shall be inspected by the District's Testing Agency.

3.10 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

- END OF SECTION -

- SECTION 03 2530 -

EXPANSION ANCHORS

PART 1 - GENERAL

1.1 RELATED INFORMATION AND REQUIREMENTS

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

1.2 SECTION INCLUDES

A. Construction: Provide material, labor, equipment, services, tests and inspections necessary for the installation of post-installed expansion anchors.

1.3 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.

1. CBC – 2007 California Building Code.
2. ACI 355.1, American Concrete Institute, “State-of-the-Art Report on Anchorage to Concrete”.
3. ASTM - American Society for Testing and Materials, designations referenced herein.
4. Federal Specifications - United States General Services Agency Federal Specifications and Commercial Item Description reports as referenced herein.
5. ICC-ES, International Code Council Evaluation Services, Evaluation Service Reports referenced herein.

1.4 SUBMITTALS

A. General: Submittals shall be sent to the Architect, or District’s Testing Agency, or both, as required herein for review prior to commencing the work. Review of submittals covers the general character of the details and to verify compliance with the performance requirements. Review does not cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

B. Manufacturer's Data: The Contractor shall submit the manufacturer’s ICC-ES report to the Architect for review.

1.5 TESTS AND INSPECTIONS

A. Notification:
   1. The Contractor shall notify the District's Testing Agency of work to be tested and inspected. Notification shall be sufficiently in advance to allow scheduling of tests and inspections, but not less than 24 hours.
   2. The Contractor shall immediately notify the Architect if the District's Testing Agency indicates that quality assurance tests and inspection requirements have not been met.

B. District's Quality Assurance Tests and Inspections:
   1. General: Quality assurance tests and inspections shall be the responsibility of the District. The District shall retain a testing agency, referred to herein as the District's Testing Agency, who shall perform the required tests and inspections, prepare written summary reports of tests and inspections, and review submittals.
   2. The District's Testing Agency shall provide special inspection to verify compliance with the specifications and the product's ICC-ES report the for following items:
      a. Drill type, bit, and setting.
      b. Hole diameter, depth, and accuracy of location.
      c. Cleanliness and surface preparation of holes.
      d. Expansion anchor type and size.
      e. Installation of expansion anchors.
      f. Torque tightening.
   3. The District's Testing Agency shall conduct static tension load tests on installed anchors. Test 10% of each diameter of anchor, or test as scheduled on the Drawings. Tests shall be in accordance with ASTM E 488, "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements".
      a. Tests shall not begin until one full day after anchor installation.
      b. Scheduled test load shall be applied for two minutes during which the maximum allowable slip shall be 1/8 inch.
      c. If an anchor fails the tension load test, additional expansion anchors shall be tension load tested until 20 consecutively successful tests have been performed.
      d. Provide tension load tests for replacement expansion anchors.
      e. The District's Testing Agency shall develop and utilize an effective method of field marking locations and results of expansion anchor tests.
         1) Field marking for test locations shall not affect exposed concrete appearance.
         2) A detailed drawing record of test locations and results shall be acceptable.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Expansion Anchors:
   1. Anchors shall conform to Commercial Item Description A-A-1923A Type 4, carbon steel or stainless steel as indicated on the Drawings.

2. Expansion anchors for use in normal weight concrete:
   a. Hilti Corporation's "Kwik Bolt TZ" (ICC-ES Report ESR-1917).
   b. Simpson Strong-Tie's "Strong-Bolt" (ICC-ES Report No. ESR-1771).
3. Expansion anchors for use in lightweight concrete (installed directly to concrete or through bottom of light gage metal deck):
   a. Hilti Corporation's "Kwik Bolt TZ" (ICC-ES Report ESR-1917).
   b. Simpson Strong-Tie's "Strong-Bolt" (ICC-ES Report No. ESR-1771).

B. Patching Mortar: BASF's "EMACO S66 CI", Sika Corporation's "SikaRepair 223", or equal.

PART 3 - EXECUTION

3.1 PROTECTION OF MATERIALS

A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

3.2 LAYOUT

A. Inspect areas to be drilled to verify conditions of access, interferences, and existing materials.
   1. Verify location of reinforcement in areas to be drilled using non-destructive methods. Contractor shall use care and caution to avoid cutting or damaging reinforcement. Maintain a minimum clearance of one inch between reinforcement and anchors or dowels, unless otherwise shown on the Drawings.

3.3 TOLERANCES

A. Anchor hole locations shall conform to tolerances for the material being attached.

3.4 DRILLING AND PREPARATION OF HOLES

A. Holes shall not be drilled in concrete that has not achieved its specified compressive strength and not until a minimum of seven days after concrete has been cast.

B. Holes shall be drilled using the manufacturer's recommended drill type, bit, and setting, unless otherwise noted on the drawings.

C. Hole diameter shall be as indicated by the manufacturer. Depth of hole shall be as indicated on the Drawings; however, in no case shall the embedment of expansion anchors be less than that required by the manufacturer.

D. Where drilling causes the concrete to spall or crack, the holes shall be considered defective work.

E. Dust and other contaminants shall be completely removed from holes by blowing with compressed air or other effective means.

3.5 ANCHOR INSTALLATION

A. Installation of anchors in the holes shall be in accordance with manufacturer's recommendations.

B. Anchors shall be tightened as recommended by the manufacturer to the installation torque values.

3.6 REPLACEMENT ANCHORS AT FAILED TEST LOCATIONS

A. At failed tension load test locations:
   1. Remove anchor.
   2. Install replacement anchors in existing holes approved by the District's Testing Agency.
   3. Existing holes not approved by the District's Testing Agency shall be considered defective work.

3.7 DAMAGED REINFORCEMENT

A. Damage to existing reinforcement shall be considered defective work.

3.8 SURFACE REPAIRS AND FILLING OF ABANDONED HOLES

A. Clean and repair surfaces damaged by drilling or installation. Cleaning and repairing requirements shall be as directed by the Architect.

B. Abandoned holes shall be filled with patching mortar in accordance with the manufacturer's recommendations.

3.9 CORRECTION OF DEFECTIVE WORK

A. Correction of defective work shall be the responsibility of the Contractor.

B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Architect.

C. Corrected work shall conform to the requirements of the Contract Documents.

D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Architect for review. The submittal shall include a description of the defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor's proposed corrections.

E. Correction of defective work shall not commence until the Architect has reviewed and accepted the submittal.

F. Correction of defective work shall be inspected by the District's Testing Agency.

3.10 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

- END OF SECTION -

- SECTION 03 3000 -

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED INFORMATION AND REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, specific Specification Sections listed below, and all other Specification Sections apply to this Section.

1. Concrete Forming
2. Concrete Reinforcing
3. Concrete Curing
4. Concrete Finishing

1.2 SECTION INCLUDES

A. Construction: Provide material, labor, equipment, services, sample panels, mock-ups, trail batches, tests and inspections necessary for the installation of cast-in-place concrete. The work also includes the following:

1. Furnishing and installation of rock base where shown under slabs-on-grade.
2. Installation of inserts, sleeves, dowels, anchor bolts and other items embedded in concrete, but furnished under other sections.

B. Engineering: Provide engineering services for the design and implementation of cast-in-place concrete mix designs.

1.3 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.

1. CBC – 2007 California Building Code.
2. ACI - American Concrete Institute, Manual of Concrete Practice, including, but not limited to, the following sections:
   a. ACI 117 “Standard Specifications for Tolerances for Concrete Construction and Materials”.
   b. ACI 211.1 “Recommended Practice for Selecting Proportions for Normal and Heavy Weight Concrete”.
   c. ACI 211.2 “Standard Practice for Selecting Proportions for Structural Lightweight Concrete”.

d. ACI 301 "Specification for Structural Concrete for Buildings".
e. ACI 302.1R “Guide for Concrete Floor and Slab Construction”.
f. ACI 304R "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete”.
g. ACI 304.2R “Placing Concrete by Pumping Methods”.
h. ACI 305R "Hot Weather Concreting".
i. ACI 306R "Cold Weather Concreting".
j. ACI 308R “Guide to Curing Concrete”.
k. ACI 309R “Guide for Consolidation of Concrete”.
l. ACI 318 “Building Code Requirements for Structural Concrete”.

3. ASTM, American Society for Testing and Materials, designations referenced herein.
4. Caltrans - California Department of Transportation, “Standard Specifications”.
5. NRMCA - National Ready-Mix Concrete Association, Quality Control Manual – Section 3: Certification of Ready Mixed Concrete Production Facilities
6. TransLab - Caltrans Transportation Laboratory, “California Test Methods” as listed herein. Note: documentation of these test methods is available on the Internet.
7. State of California, Construction Safety Orders (CAL/OSHA).

1.4 SUBMITTALS

A. General: Submittals shall be sent to the Architect, or District’s Testing Agency, or both, as required herein for review prior to producing project concrete. Review of submittals covers the general character of the details, material properties of the concrete ingredients, and to verify compliance with the performance requirements. Review does not cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

B. Shop Drawings: The Contractor shall prepare and submit shop drawings to the Architect showing:
1. Joints: Indicate details and locations of construction, control, and expansion joints.
2. Penetrations and Openings: Indicate locations and sizes of penetrations in concrete members.
3. Casting Sequence: The Contractor shall submit a proposed casting sequence for placing concrete to the Architect for review before commencing with the work. The sequence shall include the locations, extents, and structural members included in each pour.

C. NRMCA Certificate of Conformance: Submit a copy of the NRMCA Certificate of Conformance to the District’s Testing Agency for the ready-mix plant, equipment, and mix trucks that will supply the concrete for the project.

D. Product Data for Concrete Accessories: The Contractor shall submit manufacturer’s data for each product to the Architect for review.

E. Samples: When specifically requested by the Architect, provide samples of cementitious materials, aggregates, or both to the District’s Testing Agency in adequate quantity to facilitate testing of these materials for conformance with the Specifications. Aggregate samples shall be taken in conformance with the requirements listed in ASTM C 33.

F. Mix Design: The Contractor shall submit concrete mix designs for review by the Architect and District's Testing Agency at least seven days before placing concrete. Review of mix designs covers general conformance with the specifications, but does not constitute an approval of the mix proportions. Submit one mix design for each class of concrete. Each mix design shall include the following information:

1. Concrete class,
2. Member types and specific placement locations,
3. Material quantities per cubic yard,
4. Material ingredient certificates of compliance,
5. Coarse and fine aggregate sources, types, sizes, and gradation,
6. Admixture product data and dosage,
7. Design compressive strength, age (in days) required to reach design compressive strength, and compressive strength historic data,
8. Maximum water to cementitious materials ratio,
9. Design slump (or target slump range for self-consolidating mixes) at point of discharge from transit mix truck,
10. Unit weight of freshly mixed and oven-dry concrete,
11. Calculated percent water-soluble chloride ions (Cl) by weight of cement, considering the chloride ion content of all concrete ingredients,
12. Water-soluble chloride ion content historic data or trial batch test data, when required herein,
13. Contractor's Engineer's stamp and signature certifying that the concrete mix has been designed under the supervision of the Contractor's Engineer.

G. Historic data: When concrete mix design historic data is required herein to demonstrate conformance with the specification, the collected data shall satisfy the requirements stipulated for concrete mix trial batching requirements found under the "Contractor's Quality Control Tests and Inspections" section of this specification.

H. Batch Ticket Information: The Contractor shall submit a copy of each delivery ticket to the District's Testing Agency for their record.

I. Contractor's quality control test and inspection reports: The Contractor shall submit quality control test and inspection reports to the Architect and District's Testing Agency for review.

1.5 TESTS AND INSPECTIONS

A. Notification:

1. The Contractor shall notify the District's Testing Agency of work to be tested and inspected. Notification shall be sufficiently in advance to allow scheduling of tests and inspections, but not less than 24 hours.
2. The Contractor shall immediately notify the Architect if the District's Testing Agency indicates that quality assurance tests and inspection requirements have not been met.
3. The Contractor shall notify the Architect 48 hours prior to placing concrete to facilitate structural observation.

B. District's Quality Assurance Tests and Inspections:

1. General: Quality assurance tests and inspections shall be the responsibility of the District. The District shall retain a testing agency, referred to herein as the District's Testing Agency, who shall perform the required tests and inspections, prepare written summary reports of tests and inspections, and review submittals.
2. Sample tests: When the Architect requires the Contactor to submit samples for cementitious materials, aggregates, or both, the District's Testing Agency shall test the samples for conformance with the specifications.
3. Mix design and materials review: The District's Testing Agency shall review the Contractor's proposed mix designs and material certificates of compliance.
4. Batch Plant Inspections: The District's Testing Agency shall provide inspections at the Contractor's concrete batch plant as detailed in CBC 1704A.4.3 or 1704A4.4.
5. Job Site Special Inspections: The District's Testing Agency shall provide the following special inspections during the project construction:
   a. Special inspection of location of embedded items and anchor bolts and anchor rods.
   b. Special inspection of concrete placement.
6. Job-site monitoring: Where a Thermal Control Plan has been established, the District's Testing Agency shall monitor and record temperature measurements of the Contractor's thermal monitoring devices.
7. Job site samples: The District's Testing Agency shall take job site samples of fresh concrete in accordance with ASTM C 172. The volume of each sample shall be adequate to facilitate the required on-site and laboratory tests. Samples for each class of concrete shall be taken not less than once a day, or not less than once for every 150 cubic yards of concrete, or not less than once for every 5,000 square feet of surface area for slabs and walls.
   a. If the total volume of concrete for the project is such that less than five samples would be collected for a given class of concrete, samples shall be made from at least 5 randomly selected batches, or from each batch if fewer than 5 batches are used.
   b. Record the air temperature at the time of taking concrete samples.
8. Job site tests: From each sample taken, the following job-site tests shall be performed:
   a. Slump: ASTM C 143,
   b. Density and Air Content: ASTM C 138,
   c. Temperature: ASTM C 1064.
9. Collection and curing of test specimens: From each concrete sample taken, collect and cure sets of test specimens as follows:
   a. Compression cylinder test specimens: ASTM C 31. Collect a set of standard 6 by 12-inch cylinder test specimens. A set shall consist of four cylinder test specimens for concrete with compressive strength specified at 28 days or five cylinder test specimens for concrete with compressive strength specified at greater than 28 days. Test specimens shall be standard cured.
10. Laboratory tests: Test specimens shall be laboratory tested after collection and curing as follows:
    a. Perform compressive strength tests on compression cylinder test specimen sets in accordance with ASTM C 39.

1) For concrete with compressive strength specified at 28 days, one specimen from each set shall be tested at 7 days after casting, two specimens from each set shall be tested at 28 days after casting, and the remaining cylinder in each set shall be kept for further testing, if required.

2) For concrete with compressive strength specified at greater than 28 days, one specimen from each set shall be tested at 7 days after casting, one specimen from each set shall be tested at 28 days after casting, and two specimens from each set shall be tested at the age designated for determination of specified compressive strength, as indicated on the concrete mix design. The remaining cylinder in each set shall be kept for further testing, if required.

C. Contractor's Quality Control Tests and Inspections:

1. General:

a. Quality control tests and inspections shall be the responsibility of the Contractor.

b. Where required herein, the Contractor shall demonstrate that quality control conforms to the requirements of the Contract Documents.

c. Quality Control Test and Inspection Reports shall be prepared and submitted for review.

2. Concrete Mix Trial Batching: Where required herein, the Contractor's Testing Agency shall prepare concrete trial batches in accordance with ASTM C 192 as needed for preparation of test specimens. The number of batches and quantity of each batch shall be at least adequate to prepare the required number of test specimens for each of the required tests as follows. Test specimens for different tests may be taken from a single batch.

a. Compressive test specimens: Trial batch and test specimen quantity shall be in conformance with the requirements for the governing building code.

b. Water-soluble chloride ion test specimens: Prepare one trial batch. Prepare one test specimen from the trial batch and test after a minimum of 28-days after casting in conformance with ASTM C 1218.

1.6 CONTRACTOR'S ENGINEERING SERVICES

A. General: Where engineering services are required herein, the Contractor shall retain either a Civil or Structural Engineer registered in the State of California, referred to herein as the Contractor's Engineer.

1. Documents prepared by the Contractor's Engineer shall be stamped and signed.

B. Concrete mix designs shall be prepared, signed, and stamped by the Contractor's Engineer certifying that the mix design has been prepared under supervision and that the mix designs meet the requirements of the Contract Documents.

C. Temporary supports required for concrete sample panels, or mock-ups, or both, shall be designed by the Contractor's Engineer.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Water: Clean, potable, and free from deleterious material.

B. Cementitious materials and aggregates:
   1. Proven history of successful use together, or submit evidence satisfactory to the Architect that aggregate will not react harmfully in presence of alkalis in cement.
   2. From constant sources throughout the work and of the same type and source as those used in establishing mix proportions.

C. Portland cement: ASTM C 150, Type II, Low Alkali. Same brand and type of cement shall be used throughout.

D. Fly ash: ASTM C 618, Class F, with the following modified requirements:
   1. Chemical Requirements (Table 1 of ASTM C 618)
      a. Sulfur trioxide (SO_3) shall not exceed 3% by weight.
      b. Loss on ignition (L.O.I.): Maximum 1%.
   2. Physical Requirements (Table 2 of ASTM C 618)
      a. Water requirement, maximum, 100% of control.
   3. Sulfate resistance, R = 0.75% maximum, where:
      R = (C-5)/F, where:
      C = Percent CaO (Calcium Oxide)
      F = Percent Fe_2O_3 (Ferric Oxide)

E. Ground Blast Furnace Slag: ASTM C 989.

F. Aggregates:
   1. Normal weight concrete: ASTM C 33, except as modified herein.
      a. Coarse aggregates:
         1) Crushed limestone, granite, Clayton, Sechelt,
         2) Crushed gravel or gravel used as a gradation transition aggregate,
         3) Cleanness Value (CV) of not less than 75 when tested according to TransLab's California Test 227,
         4) Maximum aggregate size shall be determined by the Contractor for each class of concrete based on the parameters established in the specification subsection herein titled "Mix Designs".
      b. Fine aggregates: Sand Equivalent (SE) of not less than 75 when tested according to TransLab's California Test 217.
   2. Lightweight concrete:
      a. Coarse aggregates: ASTM C 330, expanded shale type, by rotary-kiln method,
      b. Fine aggregates: ASTM C 33.
   3. Chloride ion content: Coarse and fine aggregates for use in concrete shall be thoroughly washed and cleaned such that their water-soluble chloride ion contents do not exceed the limitations established in the submitted concrete mix designs for each class of concrete.

G. Admixtures: Admixtures containing chlorides, fluorides, sulphites, nitrates, or those that contain chemicals that may have a harmful effect on cement or aggregate, shall not be used. Combinations of admixtures in a given mix shall be chemically compatible. Acceptable admixture manufacturers include, but are not limited to W.R. Grace & Co., Master Builders, Euclid, and Sika & Co.

1. Water-reducing admixtures: ASTM C 494 Type A,
2. Retarding admixtures: ASTM C 494 Type B,
3. Accelerating admixtures: ASTM C 494 Type C, non-chloride,
4. Water-reducing and retarding admixtures: ASTM C 494 Type D,
5. Water-reducing and accelerating admixtures: ASTM C 494 Type E,
6. High-range water-reducing admixtures (superplasticizers): ASTM C 494 Type F,
7. High-range water reducing and retarding admixture: ASTM C 494 Type G,
8. Shrinkage-reducing admixture: W.R. Grace's "Eclipse", Euclid Chemical Company's "Eucon SRA", or equal,
9. Viscosity-modifying admixtures: Euclid Chemical Company's "Visctrol" or "Eucon ABS", W.R. Grace Company's "V-MAR 3", or equal,

2.2 CONCRETE ACCESSORIES

A. Preformed expansion joint fillers: ASTM D 994, ASTM D 1751, or ASTM D 1752

B. Expansive water stops for concrete construction joints: OCM's "Adeka Ultra Seal", Concrete Sealants' "CS-231", Greenstreak's "Leakmaster LV-1", or equal.

C. Rock base below slabs on grade: Below interior slabs on grade use free draining, clean, crushed rock or gravel conforming to the requirements of Class 1, Type A permeable material as specified in Section 68 of the Caltrans Standard Specifications. Below exterior slabs-on-grade (where shown on the Structural Drawings) use crushed rock or gravel conforming to the requirements of Class 2 aggregate base, 3/4" maximum aggregate size, as specified in Section 26 of the Caltrans Standard Specifications.

D. Sand cover: Sand cover on top of vapor retarder shall not be used.

E. Slab on grade bulkheads:

1. Wood bulkheads with keys, as indicated on the Drawings.
2. Preformed metal bulkheads specifically intended for slab on grade construction.

F. Expanded polystyrene (EPS) below slabs on grade:

1. Not subject to vehicular traffic: ASTM C 578.
2. Subject to vehicular traffic: Extruded, ASTM C 578 Type VII or V with minimum density of 2.0 pcf and 60 psi minimum compressive resistance at 10% deformation.

G. Cardboard fill below structural slabs above expansive soils shall be SureVoid's "SlabVoid", or VoidForm International's "FloorVoid", or equal.

H. Evaporation reducing compounds: Film-forming compound for temporary protection from rapid moisture loss. Acceptable products include "Confilm" by BASF, "Eucobar" by Euclid Chemical Co., or equal.

2.3 CONCRETE MIX DESIGNS

A. General:

1. Concrete mix designs shall be designed and documented by the Contractor's Engineer.
2. The Contractor shall review proposed concrete mix designs for compatibility with the intended placement requirements, including reinforcement layout, to ensure that the concrete, as designed, can be placed in accordance with the Contract Documents.
3. The proportions of the concrete mixes shall be such as to produce concrete for each class of concrete that conforms to the specified minimum compressive strength, and, where required, drying shrinkage, permeability, and thermal control limits, within the specified maximum water-cementitious materials ratio.
4. Aggregate size and gradation shall be determined by the Contractor, within the established limitations.
    a. The size and grading of aggregates shall be such that it will produce dense and uniform concrete free from rock pockets, honeycombs and other irregularities. The maximum size of aggregates for each class of concrete shall not be more than:
        1) 1/5 the narrowest dimension between faces of forms,
        2) 1/3 the depth of slabs,
        3) ¾ the minimum clearance between the closest spaced reinforcement bars,
        4) The minimum required concrete cover,
        5) 1 ½".
    b. Aggregate gradation shall meet the limits of ASTM C 33.
5. Determination of the amount of water in the batch shall include water contained in the aggregates.
6. The slump of wet concrete, measured at the delivery point, shall be determined and designed by the Contractor.
    a. Acceptable slump tolerances shall be as established in ASTM C 94, with the exception that slump tolerances for concrete mixes with a minimum 45% cement replacement by pozzolans may be double the listed values.
7. The plastic concrete consistency shall allow thorough compaction of the concrete into formwork corners and around concrete reinforcement without excessive puddling, spading, or vibration, and without causing the mixed materials to segregate or causing free water to collect on horizontal concrete surfaces.
8. The maximum percent water-soluble chloride ion content measured by weight of cement from the composite sum of concrete ingredients for each class of concrete shall be calculated for the concrete mix design proposed for each class of concrete. Where total calculated chloride ions exceed the CBC limits, either historic data or trial test batch data shall be submitted demonstrating that the water-soluble chloride ion content in each respective concrete mix does not exceed the allowable limits. Foundation members, slabs on grade, below grade walls, and buried roof structures shall be considered as concrete in wet conditions.

B. Normal Weight Concretes:

1. Aggregates: At the Contractor's option, up to 25% of coarse aggregates may be gravel or crushed gravel, as measured by weight.
2. Air content: 2% maximum air content measured by volume.

3. Unit weight: Wet and dry unit weight shall be calculated in conformance with ASTM C 138 and ASTM C 567, respectively. Maximum unit dry weight shall be between 147 and 153 pounds per cubic foot (pcf).
4. Cement replacement: Replacement of a portion of Portland cement by flyash and/or ground blast furnace slag is allowed for all classes of concrete with a maximum allowable replacement of 60%.
5. Normal weight concrete mixes shall be designed in accordance with the following requirements:

NORMAL WEIGHT CONCRETE MIX REQUIREMENTS (Note 1)

Concrete Class	Concrete Elements	Performance Criteria				Limiting Parameters	Additional Notes
		Minimum Compressive Strength (psi) (Note 2)	28-Day Maximum Drying Shrinkage Percentage (Note 3)	28-Day Maximum Permeability (Coulombs) (Note 4)	Mass Concrete Requirements (Note 5)	Maximum Water to Cementitious Materials Ratio (W / CM) (Note 6)	
A	Footings, grade beams	4,000	N/A	N/A	N/A	0.45	8
B	Interior slabs on grade	3,000	N/A	N/A	N/A	0.45	-
C	Exterior slabs on grade	3,000	N/A	N/A	N/A	0.45	-
D	Walls, columns	4,000	N/A	N/A	N/A	0.40	
E	Fill on metal deck	4,000	N/A	N/A	N/A	0.45	-

6. Notes:
   a. N/A stands for “not applicable”.
   b. Compressive strength shall be determined on the basis of field experience and trial mixtures as required in the CBC. Specifications are based on developing compressive strength achieved at 28 days. Greater times to achieve specified compressive strength are allowed provided formwork stripping times are adjusted accordingly. Time to achieve specified compressive strength shall not exceed 56 days.
   c. Drying shrinkage limit shall be verified by either historic data or trial batch test specimens prepared and measured in accordance with ASTM C 157 from concrete prepared in laboratory conditions in accordance with ASTM C 192.
   d. Permeability limit listed above shall be validated by either historic data or trial batch test specimens prepared and measured in accordance with ASTM C1202 from concrete prepared in laboratory conditions in accordance with ASTM C192.
   e. Mass concrete requirements: Maximum concrete temperature during curing = 180 degrees Fahrenheit, maximum temperature differential between interior and exterior concrete = 35 degrees Fahrenheit. Thermal requirements shall be verified by either historic data or trial batch test specimens; or by preparing and submitting a Thermal Control Plan for review.
   f. W = weight of water. CM = weight of cementitious materials (cement plus flyash and/or ground blast furnace slag). Any mix that uses greater than 45% cement replacement shall have a maximum W/CM of 0.38.

g. The mix design submittal for this class of concrete shall include evidence that the proposed mix meets each of the required performance criteria listed above through either trial batch test data or historic data for the exact mix to be used on this project.

h. Cement replacement: Mix shall contain a minimum of 50% and a maximum of 60% replacement of Portland cement by flyash and/or ground blast furnace slag.

C. Lightweight Concretes:

1. Air content: 4% to 7% air content measured by volume.

2. Unit weight: Wet and dry unit weight shall be calculated in conformance with ASTM C 138 and ASTM C 567, respectively. Maximum unit dry weight shall be between 107 and 113 pounds per cubic foot (pcf).

3. Lightweight concrete mixes shall be designed in accordance with the following requirements:

LIGHTWEIGHT CONCRETE MIX REQUIREMENTS (Note 1)

Concrete Class	Concrete Elements	Performance Criteria				Limiting Parameters	Additional Notes
		Specified Compressive Strength (psi) (Note 2)	Maximum Drying Shrinkage Percentage (Note 3)	Permeability (Coulombs) (Note 4)	Mass Concrete Requirements (Note 5)	Maximum Water to Cementitious Materials Ratio (W / CM) (Note 6)	
N	Fill on Metal Deck	3,000	N/A	N/A	N/A	0.50	-

D. Notes: See notes for normal weight concrete mixes above.

PART 3 - EXECUTION

3.1 PROTECTION OF MATERIALS

A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

3.2 COORDINATION

A. Coordinate locations and sizes of penetrations and openings in concrete members and verify conformance to structural requirements shown on the Drawings.

3.3 TOLERANCES

A. Dimensional tolerances shall be in conformance with ACI 117.

3.4 PREPARATION

A. Wood chips, shavings, and other debris shall be removed from the interior of the forms.

B. Existing and previously placed concrete surfaces shall be prepared as required herein.

C. Reinforcement shall be cleaned, if necessary, prior to placing concrete.

D. Reinforcement and other work to be embedded in the concrete shall be secured in position before casting.

E. Anchor bolts shall be accurately set to line and grade and shall be securely held in position such that they are not displaced while concrete is being place.

F. Pipes or conduits passing through (perpendicular to) structural concrete grade beams, joists, beams, girders, slabs, and walls shall be sleeved in Schedule 40 galvanized carbon steel or PVC sleeves as detailed on the Drawings. Adjacent pipes or conduits, passing through structural concrete, shall be spaced not less than three diameters on center and shall not displace concrete reinforcement, unless otherwise shown on the Drawings. Pipes and conduit shall not pass parallel inside of structural members except as specifically allowed in slabs and walls in this specification.

G. Electrical conduit runs in structural concrete slabs and walls, where specifically indicated as acceptable on the Drawings, shall be limited to one inch nominal conduits placed with a maximum of two crossing layers spaced at a minimum of 6 conduit diameters on center.

H. Electrical conduit shall not be allowed in concrete fill on metal deck.

I. Forms and existing concrete and masonry surfaces shall be thoroughly wetted immediately before casting.

J. Freestanding water shall be removed from forms and groundwater diverted from forms and excavations.

3.5 MIXING CONCRETE

A. Concrete shall be ready-mixed concrete and shall be mixed in accordance with ASTM C 94.

B. Concrete shall be mixed with quantities and ingredients conforming to the approved mix designs. Ingredients shall be proportioned by weight.

C. Mixed concrete shall be homogeneous in distribution of material and uniform in consistency and color. Concrete shall be mixed for at least 10 minutes after ingredients have been added, and three minutes of this time must be immediately prior to discharging at the job site. Mixed concrete shall be placed in forms within 90 minutes from the time of combination of cement and water. When air temperature is between 85 and 90 degrees F (30 and 32 degrees C), reduce mixing and delivery time to 75 minutes; when air temperature is above 90 degrees F (32 degrees C), reduce mixing and delivery time to 60 minutes.

D. Addition of admixtures shall be in accordance with manufacturer's recommendations and under the review of the District’s Testing Agency.

3.6 TRANSPORTING

A. Transport of concrete shall be in accordance with ASTM C 94.

3.7 CONVEYING

A. Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods that prevent the separation or loss of the ingredients. Deposit concrete as near as practical to its final position to avoid re-handling or flowing. Concrete shall not be dropped freely where reinforcement or embedments will cause segregation, and in no case shall it be dropped more than six feet. Spouts, elephant trunks, or other acceptable means shall be used to prevent segregation.

B. At the Contractor's option, concrete may be pumped from the transit mixer to place of deposit provided that submitted mix designs reflect selection of pumping methods. Pumps shall be adequate for the mix, aggregate size, and slump.

3.8 PLACING

A. A record shall be kept of the time and date of placing the concrete in each portion of the structure. Such reports shall be kept until the completion of the structure and shall be open to the inspection of the Architect and District's Testing Agency.

B. Concrete shall not be placed under water.

C. Concreting, once started, shall be carried on as a continuous operation until the section of acceptable size and shape is completed. Construction joints must be of acceptable detail and location.

D. Concrete shall be so deposited as to maintain, until the completion of the unit, a plastic surface approximately horizontal. No concrete shall be deposited that has started to set or stiffen. The remixing or retempering of concrete that has begun to set shall not be permitted.

E. Concrete, when placed in walls, shall not be placed in layers exceeding two feet in depth. Schedule of pouring shall be such that no concrete layer takes initial set before the next layer is placed. Concrete placement shall be scheduled such that horizontal joints in exposed exterior walls are located where shown on the Drawings without exception.

F. At least two hours must elapse after depositing concrete in walls or columns before depositing concrete in supported beams or slabs above.

G. Reinforcement, inserts, anchor bolts, welding plates, or other embedded items shall be prevented from shifting or displacing during or after concrete placement.

H. Concrete spilled on forms or reinforcement in portions of structure not immediately concreted, shall be completely removed before the concrete sets.

I. Concrete shall be placed in such a manner as to prevent staining or splattering of completed work.

J. Interruption in placement of concrete exceeding 90 minutes will be cause for stopping placement of further concrete in the affected areas. Remaining mixed concrete in hoppers or mixers shall not be placed. In case such interruption occurs, the Contractor shall provide construction joints, where and as directed, and cut concrete back to such line, cleaning forms and reinforcement as herein specified.

K. Placement of subsequent, adjacent concrete shall be staggered a minimum of 48 hours.

L. Conveyors, trucks, or buggies must be thoroughly cleaned after each pour.

3.9 HOT WEATHER PLACING:

A. During hot weather, procedures for mixing, transporting, and placing concrete shall conform to ACI 305.

3.10 COLD WEATHER PLACING:

A. During cold weather, procedures for mixing, transporting, and placing concrete shall conform to ACI 306.

3.11 CONSOLIDATION

A. Consolidation of concrete shall be in conformance with ACI 309. Concrete shall be thoroughly compacted by puddling with suitable tools during placing, and thoroughly worked around the reinforcement, around embedded fixtures and into the corners of the forms. In addition to manual spading and tamping, concrete shall be internally vibrated with high-speed mechanical vibrators. A mechanical vibrator shall be utilized at each point of placement.

B. Vibration shall be sufficient to minimize honeycombs and accomplish compaction of concrete. Do not over-vibrate as this can result in loss of entrained air or excess of fines at the concrete surfaces. In the event, during concrete placement, there is a delay of more than fifteen minutes between lifts, manipulate previously placed concrete with vibrators just prior to placement of fresh concrete.

3.12 FINISHING

A. See section titled, “Concrete Finishing”.

3.13 CURING

A. See section titled, “Concrete Curing”.

3.14 CONSTRUCTION JOINTS, KEYS, CONCRETE INTERFACES

A. Construction joints:

1. Location of construction joints shall be as shown on the Drawings. If not shown on the Drawings the following maximum distances between construction joints shall be used: 100 feet for continuous footings and grade beams, 60 feet for walls.

2. Construction joints not indicated on the Drawings shall be made and located so as not to impair the strength of the structure. Vertical construction joints in joists, beams, girders, and slabs shall be located in the middle third of the member span.
3. Reinforcement through construction joints: Extend concrete reinforcement continuously through construction joints unless otherwise shown on the Drawings. Reinforcement extensions beyond construction joint locations shall be long enough to provide the scheduled lap splice length shown on the drawings, unless mechanical couplers are utilized.
4. Construction and control joints for slabs on grade shall be located as shown on the Drawings. Concrete placement in adjacent pours shall be staggered a minimum of 48 hours. Construction and control joints shall be keyed as detailed on the Drawings.
   a. Where slab on grade construction joints are not shown on the Drawings, the maximum distance between construction joints shall be 15 feet for 5 inch thick slabs, 18 feet for 6 inch slabs, and 21 feet for 7 inch thick slabs. Maximum length-to-width ratio shall be 1.5 to 1.

B. Keys:
1. Keys shall be provided across vertical construction joints in girders, beams, slabs, walls, and other members, as detailed on the Drawings. Horizontal construction joints across joists, beams, girders, and slabs shall not be allowed unless otherwise shown on the Drawings.
2. Keys shall be provided across horizontal construction joints in walls and columns, as shown on the Drawings. Vertical construction joints shall not be allowed in columns or pilaster members, unless otherwise shown on the Drawings.

C. Concrete Interfaces:
1. Prior to placement of concrete against previously placed concrete, the previously placed concrete surfaces shall be cleaned and roughened. Surface shall be roughened utilizing sandblasting or other acceptable means. Uniformly expose the face of course aggregates embedded in the concrete mortar matrix.
2. Prior to placement of concrete against existing concrete, the existing concrete surfaces shall be free from loose concrete and laitance, cleaned, and roughened. Prepared surfaces shall meet the criteria established above for concrete placed against previously placed concrete.

3.15 SAW-CUT JOINTS

A. Saw-cut as soon as concrete has hardened sufficiently to prevent aggregates being dislodged by saw.

B. Perform all cuts cleanly and smoothly to a constant and equal depth in as continuous an operation as possible to avoid misalignment of joints. Use only experienced personnel and forms or templates as required to achieve consistent lines.

3.16 SLABS ON GRADE AND UNDERLAYMENTS

A. Rock base beneath interior slabs on grade shall be lightly tamped. Rock base under exterior slabs on grade (where shown on the Structural Drawings) shall be compacted in accordance with Section 26 of the referenced CalTrans Standard Specifications.

B. Screed supports for concrete slabs on grade placed over vapor retarders or waterproofing membranes shall be of cradle, pad, or base type that will not puncture the vapor retarder or waterproofing membrane.

3.17 EXAMINATION

A. Immediately after removing forms, concrete surfaces shall be examined for defects.

3.18 TIE HOLE FILLING

A. Form tie holes in concrete surfaces shall be plugged to effectively seal form tie metal from moisture, unless otherwise shown on the Drawings or when directed by the Architect.

3.19 PROTECTION

A. Protect cast concrete from damage from construction and weather.

B. Wheeling, working and walking on concrete shall be avoided for at least 24 hours after casting. Cover traffic areas with plywood or utilize other suitable means as necessary to protect concrete from damage.

C. Protect concrete during and after curing from damage during subsequent construction operations.

D. Concrete shall not be subjected to loads unless those loads are resisted directly by shoring until concrete has attained its specified compressive strength (but no sooner than 14 days after casting) and until curing operations have been completed.

E. Self-supporting structures shall be protected from mechanical disturbances and shall not be loaded in such a manner as to overstress the concrete.

3.20 ACCEPTANCE CRITERIA

A. Concrete shall meet the following acceptance criteria:
   1. Concrete shall conform to the established tolerances.
   2. Concrete shall meet the established performance criteria.
   3. Concrete shall be free from voids, rock pockets, cracks, pour joints, spalls, honeycombs, and air bubbles that adversely affect the structural adequacy.

3.21 CORRECTION OF DEFECTIVE WORK

A. Correction of defective work shall be the responsibility of the Contractor.

B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Architect.

C. Corrected work shall conform to the requirements of the Contract Documents.

D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Architect for review. The submittal shall include a description of the defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor's proposed corrections.

E. Correction of defective work shall not commence until the Architect has reviewed and accepted the submittal.

F. Correction of defective work shall be inspected by the District's Testing Agency.

3.22 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

- END OF SECTION -

- SECTION 03 3500 -

CONCRETE FINISHING

PART 1 - GENERAL

1.1 RELATED INFORMATION AND REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, specific Specification Sections listed below, and all other Specification Sections apply to this Section.

1. Concrete Forming
2. Concrete Reinforcing
3. Cast-In-Place Concrete
4. Concrete Curing

1.2 SECTION INCLUDES

A. Construction: Provide material, labor, equipment, services, tests and inspections necessary for the finishing of cast-in-place concrete and shotcrete.

1.3 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.

1. CBC – 2007 California Building Code.
2. ACI - American Concrete Institute, Manual of Concrete Practice, including, but not limited to, the following sections:
   a. ACI 117 " Standard Specifications for Tolerances for Concrete Construction and Materials".
   b. ACI 301 "Specification for Structural Concrete for Buildings".
   c. ACI 302.1R “Guide for Concrete Floor and Slab Construction”.
3. ASTM, American Society for Testing and Materials, designations referenced herein.

1.4 SUBMITTALS

A. General: Submittals shall be sent to the Architect, or District's Testing Agency, or both, as required herein for review prior to commencing the work. Review of submittals covers the general character of the details and to verify compliance with the performance requirements. Review does not cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

B. Product Data: The Contractor shall submit manufacturer's data to the Architect for review.

C. Sample panels: Refer to specification titled "Cast-in-Place Concrete" for sample panel submittal requirements.

D. Mock-up: Refer to specification titled "Cast-in-Place Concrete" for mock-up submittal requirements.

1.5 TESTS AND INSPECTIONS

A. Notification:
   1. The Contractor shall notify the District's Testing Agency of work to be tested and inspected. Notification shall be sufficiently in advance to allow scheduling of tests and inspections, but not less than 24 hours.
   2. The Contractor shall immediately notify the Architect if the District's Testing Agency indicates that quality assurance tests and inspection requirements have not been met.

B. District's Quality Assurance Tests and Inspections:
   1. General: Quality assurance tests and inspections shall be the responsibility of the District. The District shall retain a testing agency, referred to herein as the District's Testing Agency, who shall perform the required tests and inspections, prepare written summary reports of tests and inspections, and review submittals.
   2. Formed Surface Finish: Inspect cast finish of formed surfaces for compliance with applicable class A, B, or C surface as defined in ACI 117.
   3. Slab Finish Tolerance: Measure slab tolerance by 10-foot straightedge or measure floor flatness and levelness by ASTM E 1155 to confirm that specification limits herein have been satisfied.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Evaporation reducing compounds: Film-forming compound for temporary protection from rapid moisture loss. Acceptable products include "Confilm" by BASF, "Eucobar" by Euclid Chemical Co., or equal.

B. Slip-resistive aggregate: Factory graded, rustproof, non-glazing, and unaffected by cleaning materials. Acceptable products include “Frictex NS” by Sonneborn-Contech, “Fut-Sure” by General Abrasive Company, or equal.

PART 3 - EXECUTION

3.1 PROTECTION OF MATERIALS

A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

3.2 FINISHES FOR FORMED SURFACES

A. General: Perform subsequent finishing operations as soon as practical after stripping formwork, except as specifically noted.

B. Rough Form Finish: As cast finish obtained using rough form finish formwork. Repair honeycombed areas, fill tie holes and defects, and remove fins, offsets, and projections exceeding 1/4 inch.

C. Smooth Form finish: As cast finish obtained using smooth form finish formwork. Repair honeycombed areas, fill tie holes and defects, and remove and smooth all fins, offsets, and projections.

3.3 SHOTCRETE FINISHES

A. Natural rod finish: Natural rod finish shall be finish obtained by slicing off excess shotcrete outside of forms and ground wires with a sharp-edged cutting screed after the surface has reached initial set. Remove ground wires and remove wire impressions by floating.

B. Steel trowel finish:

1. Slice off excess shotcrete outside of forms and ground wires with a sharp-edged cutting screed after the surface has reached initial set.
2. Immediately after screeding apply thin shotcrete flash coat, containing finer than normal sand, by holding nozzle well back from work. Flash coat shall be followed by a steel trowel finish to true planes with a tolerance of a maximum deviation of 1/4” per 10 ft. when measured with a straightedge.

3.4 SLAB FINISHES

A. General: Follow ACI 302.1R recommendations for screeding, floating, restraightening, and finishing operations for slabs.

B. Evaporation Control: Protect concrete from rapid moisture loss before and during finishing operations. Apply evaporation control material prior to the commencement of finishing operations and periodically during finishing as needed. Do not apply water to the slab surface prior to the completion of finishing operations.

C. Measurement of Slab Tolerances: Measure slab finish tolerances within 72 hours after slab finishing and before removal of supporting formwork or shoring. Use the specified method and tolerance listed for each type of finish.

D. Scratch Finish: Screed and bullfloat concrete surface. Roughen the surface with stiff brushes or rakes to produce a profile of ¼ inch in one direction before final set of concrete.

1. Finish Tolerance: ½ inch in 10 feet measured by "10-ft straightedge method" in ACI 117.

E. Float Finish: Screed and bullfloat concrete surface. Consolidate surface with power-driven floats or by hand floating if area is too small or inaccessible by power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Finish Tolerance: 5/16 inch in 10 feet measured by "10-ft straightedge method" in ACI 117.

F. Light Trowel Finish: Apply float finish. Consolidate concrete surface by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks, uniform in texture, and planed to the specified tolerance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Finish Tolerance:
   a. When slab is not sloped and total project area is greater than 10,000 square feet, use the F-number system as measured by ASTM E 1155 with tolerances as follows:
      1) Flatness: Overall F(F) 30; with a minimum local value of F(F) 24.
      2) Levelness: Overall F(L) 20; with a minimum local value of F(L) 15.
   b. Otherwise, use 3/16 inch in 10 feet measured by "10-ft straightedge method" in ACI 117.

G. Hard Trowel Finish: Apply light trowel finish. Continue hand troweling until a ringing sound is produced as the trowel is moved over the surface. Final hand-troweling shall leave finished surface free of trowel marks, uniform in texture and appearance, and planed to the specified tolerance.

1. Finish Tolerance:
   a. When slab is not sloped and total project area is greater than 10,000 square feet, use the F-number system as measured by ASTM E 1155 with tolerances as follows:
      1) Flatness: Overall F(F) 30; with a minimum local value of F(F) 24.
      2) Levelness: Overall F(L) 20; with a minimum local value of F(L) 15.
   b. Otherwise, use 3/16 inch in 10 feet measured by "10-ft straightedge method" in ACI 117.

H. Broom Finish: Apply float finish. Lightly steel trowel to remove irregularities. Roughen surface by drawing a fiber bristle broom, not less than 24 inches wide, across surface perpendicular to main traffic route. Produce even texture from edge to edge, lapping adjacent strokes slightly to produce a uniform pattern.

1. Finish Tolerance: 5/16 inch in 10 feet measured by "10-ft straightedge method" in ACI 117.
2. Obtain Architect's approval for texture of final finish before application.

I. Swirl Finish: Apply float finish. Hand float using a wood float to produce a continuous swirl patterned surface, free from porous and rough spots that may be produced by disturbing particles of coarse aggregate embedded near the surface.

1. Finish Tolerance: 5/16 inch in 10 feet measured by "10-ft straightedge method" in ACI 117.
2. Obtain Architect's approval for texture and pattern of final finish before application.

J. Slip-Resistive Finish: Apply float finish. Before final floating, apply slip-resistive aggregate according to manufacturer's written instructions. Minimum rate of application shall be 25 pounds per 100 square feet. Follow spreading and tamping of slip-resistive aggregate with a final float and apply a light trowel finish.

1. Finish Tolerance: 5/16 inch in 10 feet measured by "10-ft straightedge method" in ACI 117.

3.5 FINISH SCHEDULE

A. The concrete finish types specified in the tables below shall be used except as otherwise shown on the Drawings.

B. Refer to the section titled "Concrete Forming" for formwork requirements.

Table 1: Finishes for Formed or Shotcrete Surfaces

Surface Type	Formed Concrete Surfaces	Un-formed Shotcrete Surfaces
Concealed	Rough Form Finish	Natural Rod Finish
To receive waterproofing or cement plaster	Smooth Form Finish	Steel Trowel Finish
Pits (inside face)	Smooth Form Finish	Steel Trowel Finish
Exposed to view, building interior, unless otherwise noted	Smooth Form Finish	Steel Trowel Finish
Exposed to view, mechanical rooms and storage areas	Smooth Form Finish	Steel Trowel Finish
Exposed to view, slab soffits	Smooth Form Finish	Not Applicable
Architectural Concrete Surfaces	Architectural Concrete Finish	Architectural Shotcrete Finish

Table 2: Slab Finishes

Surface Type	Finish
To receive carpet, resilient flooring, or thin-set tile	Light Trowel
To receive bonded topping or mortar bed	Scratch
To receive unbonded topping, terrazzo, or wood flooring	Float
To receive built-up waterproofing	Float
To receive fluid applied waterproofing	Light Trowel
Exposed to view, mechanical rooms and storage areas	Hard Trowel
Exposed to view, building interior	Hard Trowel

Exposed to view, ramps, stair landings, and treads	Slip-Resistive
Parking surfaces	Swirl
Exterior	Broom

3.6 CORRECTION OF DEFECTIVE WORK

A. Correction of defective work shall be the responsibility of the Contractor.

B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Architect.

C. Corrected work shall conform to the requirements of the Contract Documents.

D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Architect for review. The submittal shall include a description of the defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor's proposed corrections.

E. Correction of defective work shall not commence until the Architect has reviewed and accepted the submittal.

F. Correction of defective work shall be inspected by the District's Testing Agency.

3.7 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

- END OF SECTION -

- SECTION 03 3513 -

CONCRETE FINISHES

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. Stained and sealed concrete interior floors.

B. Wet curing blanket.

C. Slab protection blanket.

1.3 RELATED SECTIONS

A. Section 03 3000 “Cast-in-Place Concrete” for surface retarders for exposed aggregate finish.

B. Section 09 9600 “High Performance Coatings” for interior sealed concrete floor slabs.

1.4 SUBMITTALS

A. General: Submit in accordance with Section 01 3219.

B. LEED Submittals:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

    a. Include statement indicating costs for each product having recycled content.

C. Product Data: Submit product data, including chemical properties and percentage of solids, for each product.

D. Samples:

1. Submit one 24-inch by 24-inch concrete sample for each stained finish specified.
2. Coat one-half of each sample with sealer and leave one-half untreated.
3. Samples shall illustrate range of color and texture expected in final Work.

4. Resubmit samples until approved.

E. Submit following Informational Submittals:
1. Certifications specified in Quality Assurance article.
2. Qualification Data: Applicator's qualification data.
3. Manufacturer's Instructions: Application instructions, including surface preparation and application rates for each type of substrate, methods, and techniques.

1.5 QUALITY ASSURANCE

A. Applicator's Qualifications: Company specializing in performing work of this Section with 3 years minimum experience.

B. Certifications:
1. Submit manufacturer's certificate stating proper amount of materials was ordered and shipped to Project.
2. Submit sealer manufacturer's certificate indicating review of Project conditions and intent to issue extended warranty. Submittal of certificate is required prior to application of materials.

1.6 FIELD SAMPLES

A. Cast and finish four 4 foot by 4 foot panels of stained concrete finish for Architect's review of color, texture and workmanship. Provide workmanship and procedures necessary to match Architect's samples.

B. Maintain accepted sample application during construction as standard for Work.

C. Architect's Review:
1. Architect will review field sample for visual acceptance of materials and workmanship.
2. Replace unsatisfactory Work as directed by Architect.

D. Approved samples may not remain as part of the Work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01 6000.

B. Store products above 50 degrees F, but no greater than 85 degrees F, unless otherwise recommended by manufacturer.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Comply with local air pollution and safety regulations of governing authorities while performing sandblasting operations.

B. Do not apply materials when ambient or substrate surface temperatures are below 40 degrees F or higher than 100 degrees F.

C. Do not apply during inclement weather or when forecasted conditions will not permit compliance with manufacturer's printed instructions.

D. Provide mechanical ventilation during and after application to dissipate fumes if natural ventilation is insufficient.

1.9 SCHEDULING

A. Schedule application of products at proper time intervals after concrete finishing and curing operations.

B. Maintain proper moisture content of concrete before, during, and after application of specified products.

1.10 WARRANTY

A. Comply with provisions of Section 01 7700.

B. Warrant applied sealer systems to be free of defects related to material deficiency and workmanship for 5 years.

C. Warranty period begins at date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide materials, equipment, and personnel required to achieve specified finish.

B. Stained Concrete Floors: (Interior Flatwork)
1. Acceptable product: Lithochrome Chemstain Classic, L.M. Scofield Company, Los Angeles, CA 90040, or equal
2. Penetrating liquid acid stain.
   a. Colors: As selected by Architect.

C. Chemical Stains: Reactive water-based solution of metallic salts which react with the calcium hydroxide in the cured concrete substrate to produce permanent, variegated or translucent colors.
1. Number of applications: A minimum of 2 applications and as required to match Architect’s color samples.

D. Sealer:
1. Waterborne, low VOC, clear, acrylic-polyurethane sealer used as a clear sealer for stained concrete.
2. Product: Selectseal-W manufactured by L.M. Scofield Company, Los Angeles, CA 90040, or equal
3. Coats: Two coats.

4. Coordinate with Section 03 3000.

E. Floor Finish:
1. Product: Carefree, JohnsonDiversey, Sturtevant, WI 53177, tel: (800) 558-2332, or equal.
2. Gloss/Shine Level: As selected by Architect.
3. Thickness: 1 mil each coat (total thickness 5 to 6 mils).
4. Number of Coats: Five.

F. Wet Curing Blanket:
1. Natural colored cellulose fabric with a 3 mil clear impervious coating applied to on side. Material shall meet or exceed ASTM C171, ASTM C 171 and AASHTO M171-00. Ultra Cure NCF manufactured by McTech Group, Inc., Loganville, GA, tel: (619) 972-0435, contact: Gary Crowel.
2. Properties:
   a. Basis Wt: 151 g/sm per ASTM D 2103.
   b. Caliper: 1.4 mm per ASTM D 5199.
   c. Tensile:
      1) Transverse Direction: 4783 psi, per ASTM D 882.
      2) Machine Direction 4900 psi per ASTM D 882
   d. Elongation:
      1) Transverse Direction: 721%, per ASTM D 882.
      2) Machine Direction 622% per ASTM D 882
   e. Elmendorf:
      1) Transverse Direction:1500 g, per ASTM D 1922.
      2) Machine Direction 350 g, per ASTM D 1922
   f. Dart: 300 g per ASTM D 1709.

G. Protection Blanket:
1. Slab Protection Blanket for use with Colored Concrete: Natural colored cellulose fabric designed to protect colored slab-on-grade during the construction process. EZcover by McTech Group, Inc.,Loganville, GA, tel: (619) 972-0435, contact: Gary Crowel.
2. Properties:
   a. Basis Wt: 1200 g/sm per ASTM D 2103.
   b. Caliper: 3.18 mm per ASTM D 5199.
   c. Tensile:
      1) Transverse Direction: 8100 psi, per ASTM D 8882.
      2) Machine Direction 8800 psi per ASTM D 8882.
   d. Dart: 2300 g per ASTM D 1709.
   e. Reflectance: 81% per ASTM E 1447.
3. Roll Width: 8 feet.

2.2 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
   4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6 mm).
   1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
   2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
   3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by topping manufacturer.
   4. Compressive Strength: Not less than 5700 psi (39 MPa) at 28 days when tested according to ASTM C 109/C 109M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and proceed with work when substrates are ready.

B. Ensure concrete has cured for sufficient amount of time before commencing sandblasting operations in order to match texture of approved sample.

C. Verify that damage and defects in concrete surface have been repaired as specified in Section 03 3000 and accepted by Architect.

D. Verify that form ties have been broken off below concrete surface and plastic cones, fins and burrs have been removed.

E. Verify that form tie holes have been patched, unless specifically indicated to be left unfilled.

F. Verify that surfaces are clean, dry, dust free, and free of efflorescence, oil or other matter detrimental to sealer application.

G. Verify that joint sealant work in adjoining surfaces is complete prior to applications of sealers. Delay application until sealants have cured.

H. Ensure concrete has cured for time period required by manufacturer of product to be applied before application of products.

3.2 PREPARATION

A. Provide protection as necessary to protect adjacent materials and surfaces from dirt, dust, and other surface or physical damage.

B. Prevent migration of airborne materials by use of tarpaulins, wind breaks, and similar containment devices.

C. Maintain control of concrete chips, dust and debris. Collect water to prevent damage to adjacent surfaces.

D. Remove loose particles, foreign matter, and oil by method which will not affect sealer application.

E. Prepare surfaces in accordance with manufacturer's directions.

F. Provide protection as necessary to protect adjacent materials and surfaces from dirt, dust, spillage, overspray and other surface or physical damage.

3.3 APPLICATION

A. General:
   1. Provide finishes to match approved samples at locations indicated.
      a. Flatwork less than, or equal to 6 percent slope – Medium Broom Finish.
      b. Flatwork greater than 6 percent slope – Heavy Broom Finish.
   2. Apply materials in accordance with manufacturer's printed instructions.

B. Wet Curing Blanket:
   1. Place wet cure covering in widest practical width as soon as concrete has hardened sufficiently to prevent surface damage.
   2. Sides and ends shall be lapped at least 3 inches.
   3. Immediately repair any holes or tears during curing period using wet cure material and water.
   4. Cover entire surface area including edges.
   5. Install moisture containing wet cure covering material per manufacturer’s written instructions.
   6. Wet surface of slab-on-grade with 1/8 inch to 1/4 inch of water to cover entire surface area of slab, then slowly unroll the product onto slab using the roller squeegee applicator.
   7. No portion of this product shall be reused once it has been put into use on a slab on grade.
   8. Maintain wet cure material in place on concrete for a period of not less than 7 days after placement.
   9. Continuous inspection for the purpose of maintaining 100 percent curing blanket contact with surface to be cured is recommended.

C. Protection Blanket:
   1. Install protection blanket material per manufacturers written instructions.
   2. Place protective blanket on surface in widest practical width after surface has sufficiently dried or cured.
   3. Immediately repair any holes or tears, which may occur during the product application or afterward.
   4. Cover the entire interior surface area as needed to aid in prevention of surface damage.
   5. If surface contamination occurs, remove the affected area of the blanket and replace with a new portion of the product.
   6. Continuous inspections for the purpose of maintaining 100 percent protective covering contact with surface is recommended after initial application.

D. Penetrating Concrete Stain:
   1. Apply stain in number of coats and at rate indicated by manufacturer to obtain penetration and full coverage.
   2. Do not allow flooding of surface or multi-coat overlapping.
   3. Do not dilute or alter material as packaged.
   4. Provide tint and opacity to match sample.
   5. Apply sealer over stained concrete surface.

E. Sealers:
   1. Apply clear sealer over prepared substrate at manufacturer's recommended spreading rate.

F. Floor Finish:
   1. Apply five coats of floor finish, 5 to 6 mils thick for each coat, over sealer per manufacturer’s recommendations.

3.4 ADJUSTING

A. Repair or replace adjacent work which has been damaged by finishing operations.

3.5 CLEANING

A. Clean-up and remove debris daily.

B. Clean spillage, overspray, or drift from adjacent surfaces; remove immediately in accordance with manufacturer's instructions.

3.6 PROTECTION

A. Protect finished concrete surfaces from damage by construction equipment, operations and from adverse weather conditions.

- END OF SECTION -

- SECTION 03 3570 -

WATER VAPOR EMISSION CONTROL SYSTEM

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 environmentally safe, synthetic or plural polymer type barrier to form a water vapor emission and alkalinity control interface for finished floor coverings. Barrier shall be resistant to mold, mildew and biological growth when applied to prepared substrates.

1. Provide over all interior concrete slabs where floor coverings are scheduled to be installed, as specified.

B. Include in Contract Sum the cost for pre and post-installation testing of the concrete slab in accordance with ASTM F-1869 on the interior concrete area of the building slab to receive a floor covering or coating as follows: Three test kits for the first 1,000 sq. ft. and one test kit for each 1,000 sq. ft. thereafter.

1.3 RELATED SECTIONS

A. Section 01 4523 “Testing and Inspection” for independent laboratory testing of floor slabs.

B. Section 03 3000 “Cast-in-Place Concrete” for concrete slab substrate.

C. Section 06 6466 “Wood Athletic Flooring” for installation of wood athletic flooring.

D. Section 09 6500 “Resilient Flooring” for installation of resilient floor covering.

E. Section 09 6566 “Rubber Athletic Flooring” for installation of resilient athletic flooring.

F. Section 09 6813 “Tile Carpeting” for installation of carpet tiles directly adhered to the concrete floor surfaces.

G. Section 09 6816 “Sheet Carpet” for installation of broadloom carpet directly adhered to the concrete floor surfaces.

1.4 SYSTEM DESCRIPTION

A. Prescribed treatment system utilizing a water based polymer multi-coat, non-corrosive, low viscosity, high gloss, microbial resistant, moisture-alkaline resistant polymer system to suppress, control and mechanically restrict up to 10.0 lbs. of water emission and a pH level of 14 in concrete substrates for compliance with subsequent floor coverings or coating materials. In the event levels are above specified system rates, a system upgrade is required by change order.

B. Performance Requirements: It is the intention of this section and the drawings to form a guide for a complete barrier system. Any items not specifically noted but necessary for a complete barrier system shall be provided under this section.

1. System shall be compatible with all types of floor covering products, no system failures due to improper installations and contain no water/alkaline soluble compounds.
2. System shall have a sufficient density to reduce water vapor transmission, avoid water vapor damage to other adhered systems and resistant to most commonly encountered acids/solvents in case of topical exposure (spills).

1.5 REFERENCES

A. American Concrete Institute:

1. ACI 318 – Building Code Requirements for Structural Concrete.

B. ASTM International:

1. ASTM D1308 – Standard Test Method for Effort of Household Chemicals on Clear and Pigmented Organic Finishes.
2. ASTM D4541 – Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
3. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.
4. ASTM F710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
5. ASTM F1869 – Standard Test method for Measuring Moisture Vapor Emission Rate of Concrete Subflooring Using Anhydrous Calcium Chloride.

C. EPA Method 24 VOC Content Testing.

1.6 SUBMITTALS

A. Section 01 3219 “Submittal Procedures” for submittal procedures.

B. Manufacturer:

1. Product Data: Detailed installation requirements, spread rates, joint and crack treatment and final barrier surfaces for floor coverings.
2. ASTM Reports: Certified laboratory reports for specified ASTM performance.
3. Environmental: Manufacture certified letter for material VOC content.
4. Extended Warranty Certificate: Manufactures standard 15 year warranty for manufacturing defects and on site material performance. Warranty shall not list ACI-318 compliance exclusions.

5. Field Documents: Manufactures written acceptance of on site conditions including environmental conditions, concrete mix design, admixtures, concrete salts, sub slab vapor barrier, curing methods, concrete surface strength prior to application.
6. Post-Testing: Moisture testing results prior to floor coverings per ASTM F 1869.

C. Installer: Factory licensed, approved, certified applicator certificate.

1.7 WARRANTY

A. Extended Warranty: Written warranty, signed by manufacturer agreeing to repair control system that does not maintain a water vapor emission rate of 2.5 lbs. (±0.50) per ASTM F 1869 and alkalinity of less than 9.0pH for a period of fifteen (15) years.
1. Warranty shall include the replacement of control system, flooring system, patching compounds, installation accessories flooring materials and labor costs.
2. Warranty shall not exclude or become void due to non-conformance to ACI-318 parameters, dew-point, concrete salts, admixtures, resin and silicate surface treatments or cohesive substrate failure in the concrete surface due to normal concrete movement. Installation on slab surfaces deems acceptance of on site conditions.
3. Warranty may exclude unforeseen Alkali-silica reaction or Alkali-aggregate conditions as outlined by ACI-212, seismic action and flooding. Manufacturer is responsible for complete review of concrete mix designs, admixtures, sub-slab vapor retarder installed and curing methods for written acceptance prior to installations.

PART 2 - PRODUCTS

2.1 WATER VAPOR EMISSION CONTROL SYSTEM

A. Subject to compliance with requirements, provide one of the following barriers:
1. Synthetic10 by Synthetics International, Irvine, CA, tel: (866) 646-0356, web: www.SyntheticsIntl.com (Base Design Intent)
2. Vapor Remediation System by Diamond Stone Products, Phoenix, AZ, tel: 888-81-STONE web: www.diamondstoneproducts.com
3. System II by Floor Seal Technology, San Jose, CA, tel: (800) 572-2344 web: www.floorseal.com

2.2 MATERIALS

A. Type: Water based, polymer penetrant
1. Ultra low viscosity, VOC compliant, low odor, non-corrosive, microbial resistant and elastomeric properties to expand and contract with slab movement; formulated to saturate concrete surfaces and mechanically restrict moisture and alkalinity levels, and conforming to the following:

CERTIFIED INDEPENDENT LAB PERFORMANCE

Physical property, units	Test Method	Acceptable value
Water Vapor Transmission	ASTM E 96	75 – 95% Vapor Reduction
Alkali resistance	ASTM D 1308	Resistant to 30 day exposure, 14pH
Adhesion strength, psi	ASTM D 4541	400 - 600, (100% concrete failure)
VOC Content Testing	EPA Method 24	49 – 70 gram per liter

2.3 ACCESSORIES

A. Cementitious Surface: Manufacturer approved, Portland cement based compound for a smooth, non-shrink, durable surface meeting a compressive strength of not less than 3,600psi per ASTM C 109.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification: Verify substrate conditions are acceptable for a warranted system.

B. Substrate Testing: Perform calcium chloride testing in accordance with ASTM F 1869. Apply one test per 1,000 square feet and document results on a locations map for Architects review.

3.2 PREPARATION

A. Protection: Mask and protect walls, equipment from adjacent work and finishes during installation process.

B. Scarification: Scarify slab surfaces, grind near walls and clean joints as required to control system installation.

C. Cleaning: Broom-sweep and vacuum slab surfaces to remove contaminates.

D. Joints & Cracks: Fill cracks, joints, and surface irregularities with flexible non-shrink moisture-alkaline resistant layer.

3.3 INSTALLATION

A. Apply control system over entire substrate to yield required water vapor emission rates by manufacturer employed personnel, certified and approved applicator.

B. Allow surfaces to cure to the touch and re-apply are required to form a uniform control layer

C. Install cementitious materials approved by manufacturer.

3.4 FIELD QUALITY CONTROL

A. Manufacture and installer to guarantee installed treatment system is compatible with all specified floor coverings.

B. Post Testing:

1. Allow control system to cure for a 48 hour period.
2. Provide post testing to guarantee moisture reduction, in accordance with ASTM F-1869 as schedule permits. Install three test kits for the first 1,000 sq. ft. and one test kit for each 1,000 sq. ft. thereafter.
3. In the event moisture levels are above 2.5 lbs. (±0.50), manufacturer and installer shall provide additional materials and labor to reduce levels at no additional charge to Owner.

- END OF SECTION -

- SECTION 03 3900 -

CONCRETE CURING

PART 1 - GENERAL

1.1 RELATED INFORMATION AND REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, specific Specification Sections listed below, and all other Specification Sections apply to this Section.

1. Concrete Forming
2. Concrete Reinforcing
3. Cast-In-Place Concrete
4. Concrete Finishing

1.2 SECTION INCLUDES

A. Construction: Provide material, labor, equipment, services, tests and inspections necessary for the curing of concrete.

1.3 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.

1. CBC – 2007 California Building Code.
2. ACI - American Concrete Institute, Manual of Concrete Practice, including, but not limited to, the following sections:
   a. ACI 301 "Specification for Structural Concrete for Buildings".
   b. ACI 302.1R “Guide for Concrete Floor and Slab Construction”.
   c. ACI 305 “Hot Weather Concreting”.
   d. ACI 308 "Standard Practice for Curing Concrete".
   e. ACI 506R “Guide to Shotcrete”.
   f. ACI 506.2 “Specification for Materials, Proportioning, and Application of Shotcrete.”
3. ASTM, American Society for Testing and Materials, designations referenced herein.

1.4 SUBMITTALS

A. General: Submittals shall be sent to the Architect, or District's Testing Agency, or both, as required herein for review prior to commencing the work. Review of submittals covers the general character of the details and to verify compliance with the performance requirements. Review does not cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

B. Product Data: The Contractor shall submit manufacturer's data to the Architect for review.

C. Sample panels: Refer to specification titled "Cast-in-Place Concrete" for sample panel submittal requirements.

D. Mock-up: Refer to specification titled "Cast-in-Place Concrete" for mock-up submittal requirements.

1.5 TESTS AND INSPECTIONS

A. Notification:
   1. The Contractor shall notify the District's Testing Agency of work to be tested and inspected. Notification shall be sufficiently in advance to allow scheduling of tests and inspections, but not less than 24 hours.
   2. The Contractor shall immediately notify the Architect if the District's Testing Agency indicates that quality assurance tests and inspection requirements have not been met.

B. District's Quality Assurance Tests and Inspections:
   1. General: Quality assurance tests and inspections shall be the responsibility of the District. The District shall retain a testing agency, referred to herein as the District's Testing Agency, who shall perform the required tests and inspections, prepare written summary reports of tests and inspections, and review submittals.
   2. Curing inspection: Observe curing operations of all concrete to verify that products and procedures described herein have been followed, and that curing has been applied for the specified durations.

PART 2 - PRODUCTS

2.1 MOISTURE-RETAINING COVERS

A. Reinforced Curing Paper: Waterproof paper conforming to ASTM C 171, non-staining. Acceptable products include "Orange Label Sisalkraft" by Fortifiber Building Systems Group, or equal.

B. Curing Fabric: Plastic-backed burlap conforming to ASTM C 171. Acceptable products include "Curlap", or approved equal.

2.2 CURING COMPOUNDS

A. Curing Compounds: ASTM C 309, Type 1-D or 2, Class B, or ASTM C 1315, Type 1, Class A. Curing compound shall not discolor concrete or affect bonding of other finishes applied there over.

PART 3 - EXECUTION

3.1 PROTECTION OF MATERIALS

A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

3.2 CURING METHODS

A. Moist Curing: Continuous misting, sprinkling, or ponding. Intermittent wetting is not acceptable.

B. Moisture-Retaining Cover Curing: Thoroughly wet the surface of the concrete and then cover with moisture-retaining cover, placed in widest practical width, with edges lapped at least 12 inches and extended 18 inches beyond area of concrete to be cured, and sealed with waterproof tape. Maintain a film of water under the cover through the curing period by rolling back and rewetting. Immediately repair and holes or tears that occur using cover material and waterproof tape.

C. Compound Curing: Uniformly apply two coats of compound in a continuous operation with second coat at right angles to first. The total coverage for two coats shall be 200 square feet maximum per gallon of undiluted compound unless otherwise recommended by the manufacturer's written instructions. The compound shall form a uniform, continuous film that will not crack or peel. Immediately apply an additional coat of compound to areas where film is defective. Recoat concrete surfaces subjected to rainfall within 3 hours after the curing compound application. Maintain compound on the concrete surface throughout the curing period and immediately repair any damage.

3.3 CAST-IN-PLACE CONCRETE CURING

A. General: Do not permit concrete to become dry during curing period. Conform to the recommendations of ACI 308 and the following.

B. Unformed Surfaces: Start curing operations as soon as free water has disappeared from concrete surface following finishing. Curing shall be maintained for 7 days.

1. Curing Method Limitations: Accomplish curing by moist curing, moisture-retaining cover curing or compound curing subject to the following limitations.
    a. Compound curing is not permitted for surfaces to receive glue-adhered floor coverings including carpet and resilient flooring.
    b. Compound curing is not permitted for surfaces to receive bonded concrete, mortar, or plaster.
    c. Compound curing is not permitted for surfaces to receive coatings or penetrants, including but not limited to: sealers, epoxy, paint, and fluid applied waterproofing.

d. Compound curing is the only acceptable method for floors that remain exposed in completed construction.

C. Formed Surfaces: Concrete in forms shall be kept continuously wet until the forms are removed, as specified in the specification section titled Concrete Forming. If forms are removed before 7 days the concrete shall immediately be cured until the end of 7 days by one of the methods specified herein.

1. Curing Method Limitations: Accomplish curing by moist curing, moisture-retaining cover curing or compound curing subject to the following limitations.

a. Compound curing is not permitted for surfaces to receive bonded concrete, mortar, or plaster.

b. Compound curing is not permitted for surfaces to receive coatings or penetrants, including but not limited to: sealers, epoxy, paint, and fluid applied waterproofing.

3.4 COLD WEATHER REQUIREMENTS

A. When concrete will be subjected to freezing temperatures within 24 hours after placement, or when the concrete will be subjected to a period of 3 or more successive days within 7 days after placement where the average daily outdoor temperature drops below 40 degrees F, the concrete shall be protected from freezing. After placing concrete, maintain air temperature adjacent to the concrete at 50 degrees F minimum for 7 days, or 70 degrees F for a period of 3 days after placing and 40 degrees F minimum for the remaining 4 days.

3.5 HOT WEATHER REQUIREMENTS

A. When hot weather conditions will cause an evaporation rate exceeding 0.2 pounds of water per square foot per hour, as determined by Figure 2.1.5 of ACI 305, cure for initial 24 hours by moist cure or moisture-retaining cover methods.

3.6 CORRECTION OF DEFECTIVE WORK

A. Correction of defective work shall be the responsibility of the Contractor.

B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Architect.

C. Corrected work shall conform to the requirements of the Contract Documents.

D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Architect for review. The submittal shall include a description of the defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor's proposed corrections.

E. Correction of defective work shall not commence until the Architect has reviewed and accepted the submittal.

F. Correction of defective work shall be inspected by the District's Testing Agency.

3.7 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

- END OF SECTION -

DIVISION 05 – METALS

TABLE OF CONTENTS

- SECTION 05 1200 -

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED INFORMATION AND REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, specific Specification Sections listed below, and all other Specification Sections apply to this Section.

1. Cast-in-Place Concrete
2. Metal Decking

1.2 SECTION INCLUDES

A. Construction: Provide material, labor, equipment, services, tests and inspections necessary for the installation of structural steel including bracing and shoring required for erection and related work. The work also includes the following:

1. Verification of anchor bolt setting and levels to assure adequate fit of the steel work.
2. Temporary and permanent identification of SLRS protected zones.
3. Deformed bar anchors and steel reinforcing welded to structural steel.
4. Grouting of column bases.

1.3 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.

1. CBC – 2007 California Building Code.
2. AISC - American Institute of Steel Construction:
   a. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges, except as follows:
      1) Horizontal and vertical dimensions may not be shown entirely on the Structural Drawings.
      2) Division 1 requirements and those specified herein shall govern in case of conflict.
   b. ANSI/AISC 341 - Seismic Provisions for Structural Steel Buildings, Including Supplement No. 1.
   c. ANSI/AISC 358 - Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications.
   d. ANSI/AISC 360 - Specification for Structural Steel Buildings.

e. AISC - Steel Construction Manual

3. RCSC – Research Council on Structural Connections “Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.”
4. AWS - American Welding Society’s
   a. AWS D1.1 - Structural Welding Code - Steel.
   b. AWS D1.8 - Structural Welding Code - Seismic Supplement.
5. SSPC - Steel Structures Painting Council, designations referenced herein.
6. ICC Evaluation Service - Provide “Evaluation Report” for product where specified herein.
7. ASTM, American Society for Testing and Materials, designations referenced herein.

1.4 DEFINITIONS

A. Structural Steel: As defined in Section 2 of AISC 303.

B. Seismic Load Resisting System (SLRS): Members and connections designated on the Drawings to resist seismic forces, including:
   1. Collectors and chords: Framing members designated on the Drawings to receive collector connections at one or both ends.
   2. Other members and connections designated as SLRS on the Drawings.

C. Demand Critical Welds (DCW): Welds designated as DCW on the Drawings that are anticipated to be in areas of moderate to high inelastic strain demand or have a significant consequence if failure occurs.

D. Protected Zone: Areas of members and connections of the SLRS designated on the Drawings where discontinuities created by fabrication and erection operations, installation of welded shear studs, decking attachments that penetrate beam flanges and other structural and non-structural welded, bolted, screwed and shot-in attachments are restricted per ANSI/AISC 341, Section 7.4.

1.5 SUBMITTALS

A. General: Submittals shall be sent to the Architect, or District’s Testing Agency, or both, as required herein for review prior to commencing the work. Review of submittals covers the general character of the details and to verify compliance with the performance requirements. Review does not cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

B. Mill Analysis Reports: Contractor shall submit certified copies of mill analysis reports covering the chemical and physical properties of the structural steel to the District’s Testing Agency for review.

C. Certificates of Conformance: Contractor shall submit to the District’s Testing Agency for review manufacturer’s certificates of conformance for the following materials:
   1. Bolts, nuts, washers
   2. Welding electrodes, fluxes, shielding gases
   3. Welded studs.

D. Filler Metal Toughness: For SLRS and demand critical welds, submit manufacturer's certificates of conformance to the Architect and the District's Testing Agency confirming that the filler metals meet the Charpy V-Notch toughness requirements of Part 2 of this specification.

E. Shop and Erection Drawings: Contractor shall submit shop drawings to the Architect for review. Shop drawings shall include, but not be limited to, anchor bolt sizes and layout, member sizes and materials, details of members, connections, weld sizes and profiles, sizes and spacing of bolts, surface preparations and finishes, and corresponding erection plans showing the marking, position and orientation of each member and connection. Detail drawings shall indicate the marking of each member as shown on the erection plans. Shop and erection details incorporating SLRS and demand critical welds shall include explicit references to corresponding weld procedure specifications.

1. Complete horizontal and vertical control information may not be shown on the Structural Drawings and the Contractor shall obtain such information from the documents of other disciplines in order to provide a complete submittal. Prior to the preparation of detailed fabrication drawings, the Contractor shall prepare, submit, and obtain approval of coordinated erection drawings complete with horizontal and vertical dimensions.

F. Welding Procedure Specifications: Contractor shall submit welding procedure specifications (WPS) for each shop and field welding joint type and process to the Architect and the District's Testing Agency for review.

1. The WPS shall be prepared and signed by a welding professional whose qualifications include a minimum of 5 years experience with the welding technologies proposed.
2. The WPS shall include, at a minimum, the information specified in AWS D1.1, Section 3 and the supplemental provisions of Annex H.
3. Prequalified WPS may be used provided they meet the requirements of AWS D1.1, Section 3 for prequalified welds.
4. Any single deviation from the AWS D1.1 requirements for prequalified welds shall necessitate qualification by test per AWS D1.1, Section 4. WPS that are qualified by testing shall conform the additional requirements of AWS D1.1, Annex IV and shall include the corresponding Procedure Qualification Records (PQRs).
5. WPS for SLRS and for demand critical welds shall conform to the additional requirements of AWS D1.8, Section 6.1.
6. SLRS and demand critical welds shall be indicated on the applicable WPS. Alternately they may be identified in the table of contents of the WPS submittal.

G. Welder Performance Qualification Records (WPQR): Contractor shall submit WPQR for each shop and field welder to the District's Testing Agency for review.

H. Distortion Control Program: The contractor shall prepare and submit a written distortion control program that specifies welding sequence requirements for SLRS joints, including intended sequence for flange and web welding and bolting.

I. Manufacturer Data: Submit manufacturer data and ICC report for deformed bar anchors.

J. Contractor's quality control test reports: The Contractor shall submit quality control test reports to the Architect and District's Testing Agency for review.

1.6 TESTS AND INSPECTIONS

A. Notification:

1. The Contractor shall notify the District's Testing Agency of work to be tested and inspected. Notification shall be sufficiently in advance to allow scheduling of tests and inspections, but not less than 24 hours.
2. The Contractor shall immediately notify the Architect if the District's Testing Agency indicates that quality assurance tests and inspection requirements have not been met.

B. District's Quality Assurance Tests and Inspections:

1. General: Quality assurance tests and inspections shall be the responsibility of the District. The District shall retain a testing agency, referred to herein as the District's Testing Agency, who shall perform the required tests and inspections, prepare written summary reports of tests and inspections, and review submittals.
2. The District's Testing Agency shall submit written procedures, qualifications and reports as specified in ANSI/AISC 341, Appendix Q, Section Q4.
3. The District's Testing Agency shall perform tests and inspections per CBC, Chapter 17A and as follows:
    a. Collect and review certified mill analysis reports.
    b. Review steel identification per CBC Section 2203A.2. Material that cannot be identified or has a questionable source shall be tested by the Contractor's Testing Agency.
    c. Collect and review certificates of conformance. Materials not accompanied by manufacturer certificates shall be tested by the Contractor's Testing Agency.
    d. Welding Tests and Inspections:
        1) Personnel performing welding inspections and nondestructive testing shall meet the minimum qualifications specified in AWS D1.1, Section 6.
        2) Personnel performing welding inspections and nondestructive testing on SLRS and demand critical welds shall meet the additional qualifications specified in AWS D1.8, Section 7.
        3) Review shop and field WPS in accordance with AWS D1.1 and D1.8.
        4) Confirm welders, welding foreman, and QC Inspectors have a copy of the approved WPS.
        5) Review WPQR in accordance with AWS D1.1 and D1.8 for the welds to be performed.
        6) Confirm welding equipment settings, and voltage and amperage at point of welding.
        7) Perform visual inspection of shop and field welds in accordance with ANSI/AISC 341, Appendix Q, Section Q5.1. Inspections for items marked P (Perform) for both QC and QA inspections shall be the performed by the District's Testing Agency. Acceptance criteria for visually inspected welds shall be in accordance with AWS D1.1, Section 6.
        8) Perform nondestructive tests (NDT) of shop and field welds in accordance with ANSI/AISC 341, Appendix Q, Section Q5.2, except as noted below. Provide NDT equipment as required to perform specified tests.
            a) Ultrasonic testing (UT) shall conform to AWS D1.8, Section 7.10.

b) The rate of ultrasonic testing on complete joint penetration (CJP) groove welds may be reduced to 25-percent for an individual welder or welding operator after sufficient project experience is demonstrated per Appendix Q, subsection Q5.2g. However, no reduction in testing frequency shall be permitted for demand critical welds.

c) Magnetic Particle (MP) testing shall conform to AWS D1.8, Section 7.9.

d) The rate of magnetic particle testing on CJP groove welds may be reduced to 10-percent for an individual welder or welding operator after sufficient project experience is demonstrated per Appendix Q, subsection Q5.2h. However, no reduction in testing frequency shall be permitted for demand critical welds.

e. High-Strength Bolting Tests and Inspections:

1) Sample and test high strength bolts, nuts and washers in accordance with the requirements of the Specification for Structural Joints Using ASTM A 325 or A 490 Bolts.

2) Inspect installation of high strength bolts per ANSI/AISC 341, Appendix Q, Section Q5.3. Inspections for items marked P (Perform) for both QC and QA inspections shall be the performed by the District's Testing Agency.

f. Welded and bolted connections that fail to meet the acceptance criteria specified shall be re-inspected and/or re-tested after corrections have been made by the Contractor.

g. Welded Studs: Inspect size, number, placement and welding of welded studs in accordance with Section 7 of AWS D1.1.

h. Deformed Bar Anchors: Inspect size, number, placement and welding of deformed bar anchors in accordance with the manufacturer's ICC report.

i. Confirm structural and non-structural connections do not occur in the protected zones of the SLRS, except as indicated on the Drawings.

j. The District's Testing Agency shall review Contractor quality control test and inspection reports.

k. Take one set of three 2-inch mortar cubes for compressive strength tests per ASTM C 109 each day grout is placed. Test one cube 7 days after molding and two cubes at 28 days after molding.

C. Contractor's Quality Control Tests and Inspections:

1. General: Quality control tests and inspections shall be the responsibility of the Contractor. Where required herein, the Contractor shall retain a testing agency, referred to herein as the Contractor's Testing Agency, to demonstrate that quality control conforms to the requirements of the Contract Documents. Quality Control Test and Inspection Reports shall be prepared and submitted for review.

2. Welding Quality Control Inspections: The Contractor's Testing Agency shall perform visual inspection of welding per ANSI/AISC 341, Appendix Q, Section Q5.1.

a. Personnel performing quality control inspections of welding shall meet the minimum qualifications specified in AWS D1.8, Section 7.

b. The Contractor's Testing Agency need not perform inspections for items marked P (Perform) for both QC and QA inspections. These inspections will be performed by the District's Testing Agency.

3. High-Strength Bolting Quality Control Inspections: The Contractor's Testing Agency shall perform visual inspection of high-strength bolting per ANSI/AISC 341, Appendix Q, Section Q5.3.
   a. The Contractor's Testing Agency need not perform inspections for items marked P (Perform) for both QC and QA inspections. These inspections will be performed by the District's Testing Agency.
4. Tension Tests: The Contractor's Testing Agency shall conduct one tension test and one bend test in accordance with ASTM A 370 for each heat of structural steel not accompanied by certified mill analysis reports. Test reports shall be reviewed by the District's Testing Agency before placement of steel.
5. Filler Metal Toughness Tests: The Contractor's Testing Agency shall test each type of filler metal not accompanied by the manufacturer's certificate of conformance for the filler metal toughness requirements in Part 2 of this specification. Test procedures shall conform to ANSI/AISC 341, Appendix X.

D. Pre-Construction Conference: The contractor shall arrange and sponsor one preconstruction conference, following approval of project WPSs and prior to start of shop and field welding operations. At a minimum, the Contractor, Contractor's Welding Quality Control Inspector, the Contractor's Welding Foreman, the District's Testing Agency and the Engineer of Record shall attend. Attendees shall review the approved Welding Procedure Specifications (WPS) and other special welding requirements for the project. A sample agenda is included at the end of this section.

PART 2 - PRODUCTS

2.1 STRUCTURAL STEEL MATERIALS

A. Wide Flange Shapes: ASTM A 992.
   1. Heavy Sections: Heavy sections shall meet the requirements of ANSI/AISC 360, Section A3.1c. Hot rolled shapes in the SLRS with flange thicknesses 1-1/2 inch and thicker shall also have a minimum Charpy V-Notch toughness of 20 ft-lb at 70 degrees F tested in the alternate core location as described in ASTM A6, Supplementary Requirement S30.

B. Plates and Bars: ASTM A 36, typical. Provide ASTM A572, Grade 50, for SLRS, unless otherwise noted on the Drawings.
   1. Heavy Sections: Heavy sections shall meet the requirements of ANSI/AISC 360 Section A3.1d. Steel plates 2" and thicker used in the SLRS for cover plates and base plates shall also have a minimum Charpy V-notch toughness of 20 ft-lb at 70 degrees F tested at any location permitted by ASTM A673.

C. Channel and Angles: ASTM A 36.

D. Round and Rectangular Hollow Structural Sections: ASTM A 500, Grade B

E. Pipe: ASTM A 53, Grade B

2.2 FASTENER PRODUCTS AND MATERIALS

A. Anchor Rods: ASTM F1554, Grade 36 or ASTM A 36 with ASTM A 563, Grade A heavy hex nuts.

B. High-Strength Anchor Rods: Provide ASTM F1554, Grade 105 high-strength anchor rods with ASTM A 563, Grade DH heavy hex nuts where noted on the Drawings.

C. Machine Bolts: ASTM A 307, Grade A, hex headed bolts with ASTM A 563, Grade A, hex nut.

D. High-Strength Bolts: ASTM A 325, Type 1, with ASTM A 563, Grade C or DH, heavy hex nuts and ASTM F 436 washers, typical. Provide connection type N typical and X or SC where noted on the Drawings.

1. Twist-off type tension-control bolt assemblies conforming to the requirements of ASTM F 1852 shall be permitted at pretensioned bolt locations, except at slip critical bolted connections and where noted on the Drawings.
2. Compressible-washer-type direct indicators conforming to the requirements of ASTM F 959, Type 325, shall be permitted at pretensioned bolt locations except where noted on the Drawings.

E. Welded Studs: Type B headed shear studs per AWS D1.1, Section 7.

F. Deformed Bar Anchors: ASTM A 496 deformed wire. Acceptable manufacturers include Nelson Stud Welding Inc., Stud Welding Associates or equal. Alternately, welded ASTM A 706 reinforcing bars may be used.

2.3 WELDING MATERIALS AND PRODUCTS

A. Arc-Welding Filler Metals: Filler metals shall be low hydrogen types conforming to AWS D1.1, Table 3.1 and shall be as recommended by the manufacturer for the position, thickness and other conditions of use.

1. Electrode Wire Diameter: Wire diameter shall not exceed the maximum values specified in AWS D1.1, Table 3.7.
2. Filler Metal Toughness:
   a. Filler metals for shop and field welded joints designated as SLRS on the Drawings shall have a minimum Charpy V-Notch (CVN) toughness of 20 ft-lb at 0 degrees Fahrenheit as determined by AWS A5 classification test method or manufacturer certification.
   b. Filler metals for shop and field welded joints designated as demand critical welds on the Drawings shall have a minimum Charpy V-Notch (CVN) toughness of 20 ft-lb at -20 degrees Fahrenheit as determined by the appropriate AWS classification test method or manufacturer certification and 40 ft-lb at 70 degrees Fahrenheit as determined by ANSI/AISC 341, Appendix X or other approved method.

B. Arc-welding equipment: Welding equipment shall have calibrated meters for voltage and amperage that accurately indicate these values at the point of welding for the length of cable to be used. Contractor shall demonstrate to the satisfaction of the District's Testing Agency the accuracy of the meters, using external meters attached to extension cables of a length that reflects actual project conditions. If equipment meters do not accurately reflect the electrical properties at the point of welding, the Contractor shall provide external meters.

2.4 COATING PRODUCTS AND MATERIALS

A. Structural Steel Primer Paint: Alkyd based primers shall be Tnemec, Series V10, red metal primer as manufactured by Tnemec Inc., Maclac, 42 Series, red oxide primer as manufactured by R.J. McGlennon Co. Inc., or equal. Volatile Organic Compounds (V.O.C.) shall not exceed 340 grams per liter as applied.

B. Shop Galvanizing: Items noted on the Drawings or in the specifications as galvanized shall be hot-dip galvanized in accordance with ASTM A 123.

C. Galvanizing Repair: Repair materials shall conform to ASTM A 780.

2.5 MISCELLANEOUS MATERIALS AND PRODUCTS

A. Non-Shrink Grout: ASTM C 1107 premixed, non-shrink, non-staining grout. Acceptable products include Masterflow 928 grout as manufactured by BASF Construction Chemicals LLC, Edoco Non-Ferrous, Non-Shrink Grout as manufactured by Edoco Construction Chemicals, Five Star Grout as manufactured by Five Star Products Inc., or equal. Grout shall attain a minimum compressive strength of 7000-psi at 28-days.

PART 3 - EXECUTION

3.1 PROTECTION OF MATERIALS

A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

B. Provide temporary identification of SLRS protected zones prior to erection. Provide permanent identification as soon as practical after temporary identification is covered by fireproofing or paint or other finishes.

3.2 COORDINATION

A. Coordinate locations and sizes of penetrations and openings in structural steel with the Drawings and the work of other trades. Verify conformance with the structural requirements shown on the Drawings.

3.3 FABRICATION

A. General: Fabricate structural steel in accordance with AISC 303 and ANSI/AISC 360.
   1. Conform to the additional requirements of ANSI/AISC 341 for members and connections in the SLRS.

B. Dimensions: Contractor shall obtain dimensions from the Structural Drawings, drawings of the other disciplines as necessary for the fabrication of the structural steel. Complete dimensions may not be shown on the Structural Drawings.

C. Thermal Cutting: Thermal cutting shall be done by machine to the greatest extent possible. Plane thermally cut edges as necessary to comply with edge preparation requirements of AWS D1.1.

D. Bearing Surfaces: Column bases, base plates and other bearing plates shall be milled to a true plane perpendicular to the axis of the member for complete bearing at the contact face.

1. Bearing plates 2-inches or less in thickness are permitted without milling, provided a satisfactory contact bearing is obtained.
2. Top surfaces of base plates where columns are connected by CJP groove welds need not be milled.
3. Bottom surfaces of base plates to be grouted need not be milled.

E. Camber: Provide camber for beams and girders as indicated on the Drawings.

F. Anchor Rods Provide column anchor rods setting templates for installation under the section entitled “Cast-In-Place Concrete.”

1. Anchor rod holes in base plates shall conform to table 14-2 of AISC’s “Steel Construction Manual” unless otherwise noted on the Drawings.

G. Machine Bolts: Install machine bolts snug tight, unless otherwise noted on the Drawings.

H. High-Strength Bolts (HSBs): Install high strength bolts in accordance with RCSC’s “Specification for Structural Joints Using ASTM A 325 or A 490 Bolts” for the types of joints shown on the Drawings:

1. Holes for bolts shall be standard 1/16 inch larger than the nominal diameter of the bolt, unless otherwise noted on the Drawings.
2. Holes may be punched or drilled in material with a thickness not greater than the nominal bolt diameter plus 1/8 inch. Holes in thicker material shall be drilled or sub-punched and reamed. Thermal cutting of holes is not permitted. Burrs shall be removed from holes by grinding.
3. HSBs shall be fully tensioned unless otherwise noted on the Drawings.
4. Faying Surfaces: Provide Class A surfaces for connections of structural steel using slip-critical bolts. Provide Class C surfaces for connections of hot-dip galvanized steel using slip-critical bolts.

I. Welding: Welding shall conform to the requirements of ANSI/AISC 360 and AWS D1.1 using proven methods and techniques suitable for the connection configuration to be welded.

1. Use equipment that will supply the current and voltage at the point of welding shown on the approved WPS as recommended by the electrode manufacturer. Suitable meters and means of adjustment shall be provided for current and voltage.
2. Weld in accordance with the approved WPS.
3. Welders, welding foremen and the Contractor’s QC Inspector shall have a copy of and be capable of reading the approved WPS. Welders shall be qualified by tests per AWS D1.1 to perform the types of welds required.
4. Filler metals shall conform to AWS D1.1, Table 3.1.
5. Groove welds shall be complete joint penetration welds unless noted otherwise on the Drawings. Joint preparation and fit-up shall be in accordance with the approved WPS.
6. Partial penetration groove welds shall have a root face of 1/8-inch unless otherwise noted on the Drawings. Joint preparation and fit-up shall be in accordance with the approved WPS.

7. Welded connections in the SLRS shall comply with the additional requirements of AWS D1.8, including the supplemental requirements for demand critical welds, and as follows:
   a. Filler metals shall conform to the filler metal toughness requirements specified in Part 2 of this specification.
   b. Weld Access Holes: Weld access holes for CJP groove welds of beams to columns shall conform to ANSI/AISC 360, Section J1.6, unless otherwise noted on the Drawings.
   c. Welders shall pass the "Supplemental Welder Qualification for Restricted Access Welding" as specified in AWS D1.8, Section 5.1 where welding beam flanges to columns through web and gusset plate access holes at demand critical weld locations.
   d. End dams shall not be permitted, except at the outboard edge of weld tabs that are to be removed after completion of the weld.
   e. Backing bars shall be removed where noted on the Drawings.
   f. Provide reinforcing fillets where noted on the Drawings. Geometry shall be in accordance with AWS D1.8, Figure 6.1.

J. Fabrication Tolerances: Fabrication tolerances shall conform to AISC 303, unless otherwise noted.

K. Welded Studs: Install welded studs in accordance with Section 7, Stud Welding, of AWS D1.1.

L. Deformed Bar Anchors: Install deformed bar anchors in accordance with the ICC report. See section entitled "Concrete Reinforcement" for welding requirements where ASTM A 706 is used.

3.4 FINISHES

A. Surface Preparation:
   1. Remove visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants from all steel surfaces in accordance with SSPC-SP1 "Solvent Cleaning."
   2. After fabrication, remove loose mill scale, rust, paint, and other detrimental foreign matter in accordance with SSPC-SP2 "Hand Tool Cleaning" for the following steel surfaces:
      a. Steel to receive spayed-on fireproofing.
      b. Steel to be embedded or encased in concrete.
      c. Steel to be hot-dip galvanized.
   3. After fabrication, remove loose mill scale, rust, paint, and other detrimental foreign matter from steel surfaces to be primed in accordance with SSPC-SP3 "Power Tool Cleaning."

B. Shop Prime Painting:
   1. Shop prime structural steel, except as follows:
      a. Members or portions of members to be fireproofed
      b. Members or portions of members to be embedded in concrete or mortar, except for the initial 2-inches.
      c. Faying surfaces of connections using slip critical bolts.
      d. Surfaces to be field welded, including flange surfaces to receive metal decking.
      e. Surfaces to be hot-dip galvanized.

2. Immediately after surface preparation, apply structural steel primer paint in accordance with the manufacturer's instructions at a rate to provide a uniform dry film thickness of 3.0 mils. Use painting methods that will result in full coverage of joints, corners, edges and exposed surfaces.
   a. Apply two coats of primer to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

C. Hot-Dip Galvanizing:
1. Hot-dip galvanize exterior exposed steel and other members shown on the Drawings in accordance with ASTM A 123.
2. Hot-dip galvanize exterior steel bolts, nuts and washers, and other hardware shown on the Drawings in accordance with ASTM A 153.
3. After hot-dip galvanizing, roughen faying surfaces of slip critical connections by hand wire brushing to achieve Class C surface per RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts." Power wire brushing is not permitted.

3.5 ERECTION

A. General: Erect structural steel in accordance with AISC 303 and ANSI/AISC 360.
1. Conform to the additional requirements of ANSI/AISC 341 for members and connections in the SLRS.

B. Where erection requires fabrication on site, conform to the requirements of section 3.3 "Fabrication" of this Specification.

C. Machine Bolts: Install machine bolts snug tight, unless noted otherwise on the Drawings.

D. High-Strength Bolts: See section 3.3 "Fabrication" of this Specification.

E. Welding: See section 3.3 "Fabrication" of this Specification.

F. Column Base Plates: Column base plates shall be set level and to the correct elevation. Provide temporary supports until the columns have been plumbed and the base plates are grouted. The entire bearing area under base plates shall be grouted solid with non-shrink grout in accordance with the manufacturer's written instructions. Anchor bolts shall be installed snug tight, unless otherwise noted on the Drawings.

G. Structural steel shall be erected true and plumb. Temporary shoring and bracing shall be provided wherever necessary and shall be adequate for the loads to which the structure may be subjected, including wind forces, erection equipment and operation of same. Temporary shoring and bracing shall remain in place as long as required for safety and until the final framing construction is complete. Final connections shall not be made until the structure has been properly aligned.

H. Provide temporary flooring, planking and scaffolding as necessary for the erection of the structural steel and support of erection equipment. Temporary elements shall conform to applicable Federal, State and Local regulations.

I. Erection Tolerances: Erection tolerances shall conform to AISC 303, unless otherwise noted.

3.6 FIELD TOUCH-UP PAINTING

A. After erection, touch-up field welded connections and areas where shop primer has been disturbed. Surface preparation and painting shall be as specified for shop prime painting.

B. Touch-up galvanized surfaces in accordance with ASTM A 780.

3.7 CORRECTION OF DEFECTIVE WORK

A. Correction of defective work shall be the responsibility of the Contractor.

B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Architect.

C. Corrected work shall conform to the requirements of the Contract Documents.

D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Architect for review. The submittal shall include a description of the defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor's proposed corrections.

E. Correction of defective work shall not commence until the Architect has reviewed and accepted the submittal.

F. Correction of defective work shall be inspected by the District's Testing Agency.

3.8 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

SAMPLE AGENDA FOR A

PRE-CONSTRUCTION CONFERENCE

FOR

WELDING AND WELDING INSPECTION

QUALITY CONTROL

- CONTRACTOR'S QUALITY CONTROL PROGRAM
- DISTRICT'S TESTING AGENCY QUALITY ASSURANCE REQUIREMENTS
- COMMUNICATION BETWEEN CONTRACTOR AND TESTING AGENCY
- COMMUNICATION WITH THE ENGINEER

MATERIAL SPECIFICATIONS

- STRUCTURAL STEEL SHAPES AND PLATES
- BOLTS
- WELD FILLER METALS
- AESS REQUIREMENTS
- PAINT/COATINGS
- SPECIAL REQUIREMENTS
- QUALITY ASSURANCE

SUBMITTALS

- MILL CERTIFICATES
- WELD PROCEDURE SPECIFICATIONS
- DISTORTION CONTROL PROGRAM

GENERAL WELDING REQUIREMENTS

- WELDER QUALIFICATION
- POSSESSION OF THE WPS
- USE OF THE APPROVED WPS
- ENFORCEMENT OF THE WPS
- WELDING EQUIPMENT CALIBRATION AND METERS
- WELDING TECHNIQUE
- VISUAL INSPECTION CHECKLIST
- NDT INSPECTION CHECKLIST

SPECIAL “SLRS" AND “DEMAND CRITICAL WELD” REQUIREMENTS

- FILLER METALS
- PREHEAT
- POSTHEAT
- TECHNIQUE
- ACCESSORIES
- PROTECTED ZONES

- END OF SECTION -

- SECTION 05 3100 -

STEEL DECKING

PART 1 - GENERAL

1.1 RELATED INFORMATION AND REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, specific Specification Sections listed below, and all other Specification Sections apply to this Section.

1. Cast-In-Place Concrete.
2. Structural Steel.

1.2 SECTION INCLUDES

A. Construction: Provide material, labor, equipment, services, tests and inspections necessary for the installation of composite and non-composite floor and roof steel decking, accessories and welded studs.

1.3 REFERENCE DOCUMENTS

A. Standards: Comply with the provisions of the documents listed below and with the requirements described in this Section. Use current editions of documents unless earlier editions are specifically referenced by the governing code or are otherwise indicated.

1. CBC – 2007 California Building Code.
2. AISI - American Iron and Steel Institute, "Specification for the Design of Cold-Formed Steel Structural Members."
3. AWS - American Welding Society
   a. AWS D1.1 Structural Welding Code - Steel
   b. AWS D1.3 Structural Welding Code – Sheet Steel
4. SDI – Steel Deck Institute
   a. Publication No. 31 – Design Manual for Composite Decks, Form Decks and Roof Decks.
5. SSPC - Steel Structures Painting Council, designations referenced herein.
6. ICC Evaluation Service - Provide “Evaluation Report” for product where specified herein.
7. ASTM, American Society for Testing and Materials, designations referenced herein.

1.4 SUBMITTALS

A. General: Submittals shall be sent to the Architect, or District's Testing Agency, or both, as required herein for review prior to commencing the work. Review of submittals covers the general character of the details and to verify compliance with the performance requirements. Review does not cover checking of quantities, proportions or dimensions. Such review shall not relieve the Contractor from responsibility for executing the work in accordance with the Contract Documents.

B. Shop Drawings: The Contractor shall submit shop drawings for review by the Architect showing the layout, fabrication and installation details, locations and dimensions of openings, opening reinforcing, and sizes and locations of welds and welded studs. Fabrication or delivery of material to the building site shall not begin until the Architect's review is complete.

C. Manufacturer's Data: Submit current ICC report for steel decking, including allowable vertical load and diaphragm shear capacities.

D. Certified Mill Analysis Reports: The Contractor shall submit certified mill analysis reports in accordance with ASTM designations referenced herein for each heat of steel decking, welded studs and welding electrodes to the District's Testing Agency for review.

E. Welding Documents: The Contractor shall submit Welding Procedure Specifications (WPSs), Procedure Qualification Records (PQRs), and Welder Qualification Test Records (WQTRs) prepared in accordance with AWS D1.3 for each type of weld and position to be performed to the District's Testing Agency for review.

F. Contractor's quality control test reports: The Contractor shall submit quality control test reports to the Architect and District's Testing Agency for review.

1.5 TESTS AND INSPECTIONS

A. Notification:
   1. The Contractor shall notify the District's Testing Agency of work to be tested and inspected. Notification shall be sufficiently in advance to allow scheduling of tests and inspections, but not less than 24 hours.
   2. The Contractor shall immediately notify the Architect if the District's Testing Agency indicates that quality assurance tests and inspection requirements have not been met.

B. District's Quality Assurance Tests and Inspections:
   1. General: Quality assurance tests and inspections shall be the responsibility of the District. The District shall retain a testing agency, referred to herein as the District's Testing Agency, who shall perform the required tests and inspections, prepare written summary reports of tests and inspections, and review submittals.
   2. The District's Testing Agency shall perform tests and inspections in accordance with CBC Chapter 17, AWS D1.3, and AWS D1.1 where indicated:
      a. Review WPSs, PQRs, WQTRs and suitability of welding equipment.
      b. Inspect layout of steel deck and welding of deck to supports.
      c. Inspect size, number, placement and welding of welded studs in accordance with Section 7 of AWS D1.1.

3. The District's Testing Agency shall review Contractor quality control test and inspection reports.

C. Contractor's Quality Control Tests and Inspections:

1. General:
   a. Quality control tests and inspections shall be the responsibility of the Contractor.
   b. Where required herein, the Contractor shall demonstrate that quality control conforms to the requirements of the Contract Documents.
   c. Quality Control Test and Inspection Reports shall be prepared and submitted to the Architect and District's Testing Agency for review.
2. Tension tests of steel deck not accompanied by certified mill analysis reports: The Contractor shall conduct one tension test and one bend test in accordance with ASTM A 370 for each 5 tons or fraction thereof of each size or gage of steel deck not accompanied by certified mill analysis reports. Test reports shall be reviewed by the District's Testing Agency before placement of reinforcement.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Decking, Closures and Edge Angles:

1. Acceptable Manufacturers: Decking and accessories shall be as manufactured by ASC Profiles, Inc. (ESR-1414), Verco Manufacturers, Inc. (ESR-2078), or approved equal.
2. Materials: Form from steel conforming to ASTM A 653, SS, Grade 33, with a minimum yield strength of 38,000 psi. Before forming, the steel shall receive a protective zinc coating conforming to ASTM A 653, G60 minimum.
3. Vent Tabs: Steel deck supporting concrete fill shall have factory punched vent tabs, unless otherwise noted on the Drawings. Steel deck without concrete fill shall not be vented.
4. Fire Resistance: Decks shall have been tested for fire resistance per ASTM E119 as part of an assembly of the type shown on the Drawings and shall be listed in the UL "Fire Resistance Directory."

B. Miscellaneous Steel Shapes and Plates: ASTM A 36.

C. Welded Studs: Type B headed shear studs per AWS D1.1, Section 7.

D. Arc-Welding Electrodes: Conform to Table 5.1 of AWS D1.3 and Table 3.1 of AWS D1.1. Electrodes shall be as recommended by the manufacturer for the position or other conditions of use.

E. Galvanizing Repair Paint: Zinc-Rich Primers conforming to SSPC-Paint 20.

PART 3 - EXECUTION

3.1 PROTECTION OF MATERIALS

A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

3.2 COORDINATION

A. Coordinate locations and sizes of penetrations and openings in steel decking with the Drawings and the work of other trades. Verify conformance with the structural requirements shown on the Drawings.

3.3 FABRICATION

A. General Requirements: Properties of steel deck sections shall be computed in accordance with the AISI Specification. Decking units to receive concrete fill shall be designed with adequate provisions to transfer shear and to prevent vertical separation.

B. Deck sizes, profiles, gages and minimum properties shall be as shown on the Drawings.

C. Fabrication, cuts, etc., shall be done in the shop in accordance with SDI standards and the manufacturer's recommendations. All deck units shall be shipped to the field in standard widths and precut lengths.

D. Deck units shall be supplied in lengths to span over at least three supports where layout permits.

E. Deck units shall abut over framing supports with minimum bearing as shown on the Drawings.

F. Fabricate closure strips of galvanized sheet steel of the same quality as the deck units, not less than 18 gage thick before coating. Form to the configuration required to provide tight-fitting closures at open ends and sides of decking.

G. Provide 14-gage weld plates for shear transfer where the deck low flutes do not align with beams parallel to the deck. See Drawings for details.

H. All deck units shall be provided with either an interlocking side laps or lapping type side laps.

3.4 INSTALLATION

A. Steel decking shall be installed in the field by a steel deck contractor with a minimum of 5-years experience.

B. Installation work shall be performed by workers skilled in their trade, in conformance with SDI standards and the manufacturer's recommendations.

C. The steel deck units shall be placed on the supporting framework, aligned, and adjusted to final position before being permanently fastened. Each unit shall be brought to proper bearing on the supporting beams. If the supporting beams are not properly aligned or sufficiently level to permit proper bearing of steel units, notify the Architect before taking corrective action.

D. Deck units shall be placed in straight alignment for the entire length of run with close registration of the cells of one unit with those of abutting and adjoining units. Provide minimum end lapping of lapped units or butting of abutting units as noted on the Drawings.

E. Provide flashings and closures where required to prevent concrete leakage. Provide between decking and columns and at open ends of all cell runs at columns, walls, openings, etc., and those that occur where cells change direction. Closure pieces shall be cut same shape as deck profile as shown on the Drawings. Fasten in place by welding or sheet metal screws per manufacturer's printed directions, unless noted otherwise on the Drawings.

F. Galvanizing Repair: Where galvanized surfaces are damaged, repair surfaces with zinc rich paint in accordance with procedures specified in ASTM A 780.

3.5 WELDING

A. Make welds in accordance with Drawings. Use only welders certified for welding sheet steel per AWS D1.3. Button-punching or riv-clinching of deck will be permitted for vertical alignment only, unless otherwise noted on the Drawings. Crimp deck sections together at vertical side seams before welding.

B. Welded studs shall be welded through steel deck to beam flanges in accordance with Section 7, Stud Welding, AWS D1.1.

3.6 REINFORCEMENT AT OPENINGS

A. Provide reinforcement and closure pieces at openings as shown and detailed on the Drawings.

B. Not all openings are shown on the Drawings. Openings not shown, such as openings required for ducts, stacks, conduits, plumbing, etc., shall be cut, closed, supported, and reinforced by the trade requiring the openings in accordance with the structural requirements shown on the Drawings.

3.7 CORRECTION OF DEFECTIVE WORK

A. Correction of defective work shall be the responsibility of the Contractor.

B. Work not in compliance with the requirements of the Contract Documents shall be considered defective, unless otherwise directed in writing by the Architect.

C. Corrected work shall conform to the requirements of the Contract Documents.

D. The Contractor shall prepare a submittal documenting the defective work and proposed corrections and submit to the Architect for review. The submittal shall include a description of the defective work, the location of defective work, and shall be accompanied by supporting sketches, photographs, or both. Additionally, the submittal shall include similar documentation of the Contractor's proposed corrections.

E. Correction of defective work shall not commence until the Architect has reviewed and accepted the submittal.

F. Correction of defective work shall be inspected by the District's Testing Agency.

3.8 CLEAN-UP

A. Remove from the site all debris resulting from the work of this Section.

- END OF SECTION -

- SECTION 05 4000 -

COLD-FORMED METAL FRAMING

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. Cold-formed metal framing for:
   1. Interior load-bearing wall framing.
   2. Exterior non-load-bearing wall framing.

1.3 RELATED SECTIONS

A. Section 05 5000 “Metal Fabrication" for shelf angles and connections.

B. Section 09 2216 "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.4 REFERENCES

A. SSMA – Steel Stud Manufacturer Association

B. ASTM A 780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

C. ASTM A 1003 - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

D. ASTM B 633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

E. ASTM C 955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.

F. ASTM C 1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.

G. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

H. AISI - Standard for Cold-Formed Steel Framing General Provisions.

I. AISI - Specification for the Design of Cold-Formed Steel Structural Members.

J. AWS D.1.3 - Structural Welding Code - Sheet Steel.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 3219.

B. Product Data: Submit manufacturer's product literature, data sheets and installation recommendations for specified products.

C. LEED Submittal:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
    a. Include statement indicating costs for each product having recycled content.

D. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Welding certificates.

F. Qualification Data: For testing agency.

G. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

H. Research/Evaluation Reports: For cold-formed metal framing.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.

D. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

F. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

G. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

H. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Store materials protected from exposure to rain, snow or other harmful weather conditions, at temperature and humidity conditions per the recommendations of ASTM C955.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Dietrich Metal Framing; 500 Grant Street, Suite 2226, Pittsburgh, PA 15219. ASD. Tel: (412) 281-2805. Fax: (412) 281-2965. E–mail: askforhelp@dietrichindustries.com. Web: www.dietrichmetalframing.com.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

1. Allied Studco.
2. AllSteel Products, Inc.
3. California Expanded Metal Products Company.
4. Clark Western Building Systems.
5. Consolidated Fabricators Corp.; Building Products Division.
6. Craco Metals Manufacturing, LLC.
7. Custom Stud, Inc.
8. Dale/Incor.
9. Design Shapes in Steel.
10. Dietrich Metal Framing; a Worthington Industries Company.
11. Formetal Co. Inc. (The).
12. Innovative Steel Systems.
13. MarinoWare; a division of Ware Industries.
14. Quail Run Building Materials, Inc.
15. SCAFCO Corporation.
16. Southeastern Stud & Components, Inc.
17. Steel Construction Systems.
18. Steeler, Inc.
19. Super Stud Building Products, Inc.
20. United Metal Products, Inc.

2.2 COMPONENTS

A. Studs: Cold formed galvanized steel C-studs; Dietrich Big "D" Steel C-Studs:

1. Sizes: As indicated on drawings.
2. Minimum Yield Strength: As indicated on drawings.
3. Minimum Delivered Thickness: 16 gauge, 0.0538 inch (1.37 mm).

B. Runner Track: Cold formed galvanized steel sheet; Dietrich Big "D" Structural Runner Track:

1. Designation: Equal Leg.
2. Minimum Yield Strength: 33 ksi (227 MPa) (for 20 through 12 gauges only).
3. Web Sizes: As required to match the system stud size.
4. Material thickness to match stud/joist thickness unless design dictates heavier thickness.

C. SLP-TRK Systems - Slotted Deflection Track
   1. Standard leg of 2 1/2 inches.
   2. Standard vertical slot of 1 1/2 inches in leg.
   3. Thickness: 16 gage (1.44 mm).
   4. Product available with 2 1/2 drift slots in web 'special order.'
   5. Minimum yield strength of 50 k.s.i. in 16 gauge and heavier.

D. Deflection Clips:
   1. Slide Clips: Minimum Delivered Thickness: 12 gauge, 0.0966 inch (2.45 mm).
   2. Fast Top Clip: Minimum Delivered Thickness: 14 gauge, 0.0677 inch (1.72 mm)
   3. Fast Strut Clip: Minimum Delivered Thickness: 14 gauge, 0.0677 inch (1.72 mm)
   4. Fast ClipSlide Clip: Minimum Delivered Thickness: 14 gauge, 0.0677 inch (1.72 mm)
   5. QuickClip: Minimum Delivered Thickness: 10 gauge, 0.1180 inch (3 mm)

E. Bridging/Spacer Bar: Dietrich TradeReady Spazzer 5400 Bridging and Bracing Bar.

F. Minimum Delivered Thickness: 16 gauge, 0.0538 inch (1.37 mm).
   1. 1-1/4 by 1-1/4 by 50 inches (32 by 32 by 1270 mm) long pre-notched at 16 by 24 inches (406 by 610 mm) centers.
   2. Dietrich TradeReady Spazzer Bar Guard: Minimum Delivered Thickness: 20 gauge, 0.0329 inch (0.84 mm)

G. Framing Component Accessories: Provide the following accessories as required for a complete system.
   1. Flat strapping.
   2. Angles, plates, sheets.
   3. Custom brake-formed shapes.

H. Fasteners: Self-drilling, self-tapping screws; Steel, complying with ASTM C1513; Galvanized coating, plated or oil-phosphate coated complying with ASTM B 633 as needed for required corrosion resistance.

I. Touch-Up Paint: Zinc rich, containing 95-percent metallic zinc, ZRC 350 as manufactured by ZRC Worldwide, Marshfield, MA.

2.3 MATERIALS

A. Cold-Formed Steel Sheet: Complying with SSMA, ICBO 4943P; unless indicated otherwise.

B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

2.4 FABRICATION

A. General: Framing components may be pre-assembled into panels prior to erecting.

B. Fabricate panels square, with components attached in a manner so as to prevent racking or distortion.

C. Cut all framing components squarely for attachment to perpendicular members, or as required for an angular fit against abutting members. Hold members positively in place until properly fastened.

D. Provide insulation as specified elsewhere in all double jamb studs and double header members, which will not be accessible to the insulation contractor.

E. Axially Loaded Studs:
   1. Install studs to have full bearing against inside track web (1/8 inches (3.2 mm) maximum gap) prior to stud and track attachment.
   2. Splices in axially loaded studs are not permitted.
   3. Fasteners: Fasten components using self-tapping screws or welding.

F. Welding: Welding is permitted on 18 gauge or heavier material only.
   1. Specify welding configuration and size on the Structural Calculation submittal.
   2. Qualify welding operators in accordance with Section 6.0 of AWS D.1.3.
   3. Touch up all welds with zinc-rich paint in compliance with ASTM A 780.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation, inspect previous work of all other trades. Verify that all work is complete and accurate to the point where this installation may properly proceed in strict accordance with framing shop drawings.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 ERECTION

A. General Erection Requirements:
   1. Install cold-formed framing in accordance with requirements of ASTM C1007.
   2. Weld in compliance with AWS D.1.3.
   3. Install in compliance with applicable sections of the AISI Standard for Cold-Formed Steel Framing General Provisions.

B. Wall Systems:
   1. Erect framing and panels plumb, level and square in strict accordance with approved shop drawings.
   2. Handle and lift prefabricated panels in a manner so as not to cause distortion in any member.

3. Anchor runner track securely to the supporting structure as shown on the erection drawings. Install concrete anchors only after full compressive strength has been achieved. Provide a sill sealer or gasket barrier between all concrete and steel connections.
4. Butt all track joints. Securely anchor abutting pieces of track to a common structural element, or butt-weld or splice them together.
5. Align and plumb studs, and securely attach to the flanges or webs of both upper and lower tracks except when vertical movement is specified.
6. Install jack studs or cripples below window sills, above window and door heads, at freestanding stair rails and elsewhere to furnish support, securely attached to supporting members.
7. Attach wall stud bridging in a manner to prevent stud rotation. Space bridging rows according to manufacturer's recommendations.
8. Frame wall openings to include headers and supporting studs as shown in the drawings.
9. Provide temporary bracing until erection is completed.
10. Provide stud walls at locations indicated on plans as "shear walls" for frame stability and lateral load resistance.
11. Where indicated in the drawings, provide for structural vertical movement using a vertical slide clip or other means in accordance with manufacturer's recommendations.

3.3 PROTECTION

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

- END OF SECTION -

- SECTION 05 5000 -

METAL FABRICATIONS

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. Shop fabricated metal items and miscellaneous metal work to include the following:
   1. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   2. Steel framing and supports (outriggers) for metal canopy including mounting brackets, frame and anchorages.
   3. Steel framing and supports for countertops.
   4. Steel shapes for supporting elevator door sills.
   5. Steel weld plates and angles for casting into concrete not specified in other Sections.
   6. Elevator machine hoist beams
   7. Miscellaneous stainless steel base trim.
   8. Metal elevator pit ladder.
   9. Metal ship's ladder.
   10. Metal bollards.
   11. Metal downspout boots.
   12. Metal angle corner guards.
   13. Stainless steel base.
   14. Abrasive metal nosings.
   15. Loose bearing and leveling plates for applications where they are not specified in other Sections.

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

1.3 RELATED SECTIONS

A. Section 03 3000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts and other items cast into concrete.

B. Section 05 1200 "Structural Steel Framing."

C. Section 05 5100 “Metal Stairs” for fabricated architectural metal stairways.

D. Section 05 5213 “Pipe and Tube Railings” for fabricated metal railing system to include structural plate balusters and tube horizontal rails.

E. Section 05 7300 "Decorative Glass Railings."

F. Section 09 9600 “High Performance Coatings” for preparation, priming with compatible products and finish paint coatings.

1.4 QUALITY ASSURANCE

A. Standards and References: (Latest Edition unless otherwise noted)
   1. 2003 International Building Code (IBC)
   2. American Society for Testing and Materials (ASTM) Specifications as listed in the Section.

B. Submittals: Submit under provisions of Section 01 3219.
   1. Shop Drawings: Submit shop drawings indicating profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevation, and details where applicable. Indicate welded connections using standard AWS welding symbols. Indicate net weld lengths.
   2. Manufacturer's descriptive data: Submit for manufacturer's items.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver all parts ready for erection; store in close proximity to final locations.

1.6 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.7 SUBMITTALS

A. Product Data: For the following:
   1. Nonslip aggregates and nonslip-aggregate surface finishes.
   2. Metal nosings and treads.
   3. Paint products.
   4. Grout.

B. LEED Submittal:
   1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
      a. Include certificate indicating costs for each product having recycled content.
   2. Product Data for Credit EQ 4.2: For paints, including printed statement of VOC content and chemical components.
   3. Local/Regional Materials:
      a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
      b. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
      c. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
      d. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

C. Shop Drawings: Show fabrication and installation details for metal fabrications.
   1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
   2. Provide templates for anchors and bolts specified for installation under other Sections.
   3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Where installed metal fabrications are indicated to comply with certain design loadings, include structural computations, material properties, and other information needed for structural analysis that has been signed and sealed by the qualified professional engineer who was responsible for the preparation.

E. Samples for Verification: For each type and finish of extruded nosing.

F. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

G. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. 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 concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Sections: ASTM A36.

B. Steel Tubing: ASTM A500, Grade B.

C. Steel Pipe: ASTM A53, Type E or S, Grade. B.

D. Steel Bolts, Nuts, and Washers: ASTM A307.

E. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.

F. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

G. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.

H. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

I. Welding Materials: AWS D1.1; type required for materials being welded.

J. Galvanizing: Hot-dip process ASTM A123 typical and ASTM A153 for threaded fasteners performed after fabrication into largest practical section. Weight of coating not less than 2 oz. per sq. ft. of surface. Where damaged, repair surface with one coat of hot process galvanizing repair compound, "Galvalloy", Galvweldalloy", or approved equal.

K. Primer: Tnemec Company "69 Special Red Primer", Rust Oleum Corporation "1069 Heavy Dusty Rust Inhibitor Red Primer", Sherwin-Williams "Kern Kromick Primer"; or approved equal.

L. Dissimilar Materials: Separate dissimilar surfaces in contact with or in close proximity to non-compatible metals, concrete masonry, or plaster with neoprene gasket; or other approved means.

M. Expansion Bolts: Hilti "Kwik Bolt III" Expansion Anchor Bolts, galvanized unless otherwise indicated.

N. Non-shrink Grout: Master builders 928 or equal.

2.2 FABRICATION, GENERAL

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.

B. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

C. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

D. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.

1. Temperature Change (Range): 100 deg F.

E. Shear and punch metals cleanly and accurately. Remove burrs.

F. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

G. Remove sharp or rough areas on exposed traffic surfaces.

H. 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 so that no roughness shows after finishing, and contour of welded surface matches those adjacent.

I. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

J. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

K. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

L. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

M. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.3 ROUGH HARDWARE

A. Furnish bent, or otherwise custom-fabricated, bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 Sections.

B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts that bear on wood structural connections, and furnish steel washers elsewhere.

2.4 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.

B. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.
   1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
      a. Except as otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long.

C. Galvanize miscellaneous framing and supports in the following locations:
   1. Exterior locations.
   2. Interior locations where indicated.

2.5 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices wherever possible.

B. Provide cutouts, fittings, and anchorages as required to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than 6 inches from each end, 6 inches from corners, and 24 inches o.c., unless otherwise indicated.

C. Galvanize miscellaneous steel trim in the following locations:
   1. Exterior locations.
   2. Interior locations where indicated.

2.6 ANGLE FRAMES AND EDGE ANGLES

A. Corner Angles:
   1. Provide corner angles, extending from floor to 42 inches above floor, with 3/8-inch steel base plates for bolting to floor. Provide at least two vertical angles at each location, except at internal corners where one may be used.
   2. Anchor to edge angles to wall and column with 1/4-by-2-inch steel strap braces welded to angles on 30 inch centers (minimum of two for wall angles.
   3. Provide edge angles and anchors for placement in fresh concrete.
   4. Galvanize exterior edge angles after fabrication.

B. Lateral Supports for Storefronts:
   1. Structural steel angles, sized for spans and wind loads, to support storefronts to structures.
   2. Securely fasten angles to storefront and structure.

C. Vanities and Countertops: Provide framing to support countertops.

D. Complete with anchors and bolts. For casting in concrete, space anchors 24 inches OC with 1-1/4 inches by 1/4 inch by 8 inches steel straps.

E. Finish: Universal primer.
   1. Provide steel supports as required by folding partition manufacturer.
   2. Continuous steel shapes and beams of sizes indicated with attached bearing plates, anchors, and braces as indicated.
   3. Drill holes and provide threaded rod as required by partition manufacturer.
   4. Locate holes where indicated on operable partition Shop Drawings.
   1. Provide edge angles of 3-by-3-by-5/16-inch steel angles for loading dock edges.
   2. Anchor edge angles to loading dock with steel strap anchors welded to angles.
   3. Provide edge angles and anchors for placement in fresh concrete.
   4. Galvanize exterior edge angles after fabrication.
   5. Complete with anchors and bolts. For casting in concrete, space anchors 24 inches OC with 1-1/4 inches by 1/4 inch by 8 inches steel straps.

2.7 FIXED STEEL LADDERS

A. General: Fabricate ladders for locations shown, with dimensions, spacings, details, and anchorages as indicated.
   1. Comply with ANSI A14.3, unless otherwise indicated.

B. Ladder Extensions: Provide 42" ladder extension device for fixed ladders under access hatches and floor doors.

C. Siderails: Continuous, 1/2-by-2-inch steel flat bars, with eased edges, spaced as shown on Drawings.

D. Bar Rungs: 3/4-inch-diameter steel bars, spaced 12 inches o.c.

E. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.

F. Support each ladder at top and bottom at intermediate points spaced and not more than 60 inches o.c. with welded or bolted steel brackets. Size brackets to support design loads specified in ANSI A14.3 and to hold centerline of ladder rungs clear of the wall surface by minimum 7 inches.

G. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung by a proprietary process.
   1. Products: Subject to compliance with requirements, provide one of the following
      a. Mebac; IKG Borden.
      b. SLIP-NOT; W. S. Molnar Company.

H. Galvanize ladders, including brackets and fasteners, in the following locations
   1. Exterior.

2.8 METAL SHIPS' LADDER

A. Provide metal ships' ladders where indicated. Fabricate of open-type construction with channel or plate stringers, pipe and tube railings, and bar grating treads and landing, unless otherwise indicated. Provide brackets and fittings for installation.
   1. Fabricate ships' ladders, including treads and railings from steel.
   2. Comply with applicable requirements in Section 05 5213 "Pipe and Tube Railings" for railings.

B. Hot-dip galvanize exterior steel ships' ladders including treads, railings, brackets, and fasteners.

C. Prime exterior steel ships' ladders, including treads, railings, brackets, and fasteners, with zinc-rich primer.

2.9 PIPE BOLLARDS

A. Fabricate pipe bollards from Schedule 80 steel pipe.

B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch-thick steel plate welded to bottom of sleeve.

2.10 METAL DOWNSPOUT BOOTS

A. Provide downspout boots made from cast bronze in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.
   1. Outlet: At 35 degrees from horizontal, to discharge onto splash block or pavement.

2.11 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.

B. Galvanize plates.

C. Prime plates with zinc-rich primer.

2.12 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. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches (200 mm) unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.13 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.

2.14 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.15 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer unless primers specified in Division 9 Section "High-Performance Coatings" are indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
   1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   3. Items Indicated to Receive Primers Specified in Division 9 Section "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   4. Other Items: SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

E. Stainless Steel Finishes:
   1. Remove tool and die marks and stretch lines or blend into finish.
   2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
   3. Bright, Directional Satin Finish: No. 4.
   4. Dull Satin Finish: No. 6.
   5. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

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. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

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

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
   1. Cast Aluminum: Heavy coat of bituminous paint.
   2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
   1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
   1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING PREFABRICATED BUILDING COLUMNS

A. Install prefabricated building columns to comply with AISC's "Specification for Structural Steel Buildings" and with requirements applicable to listing and labeling for fire-resistance rating indicated.

3.4 INSTALLING METAL BOLLARDS

A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
   1. Do not fill removable bollards with concrete.

B. Anchor bollards in concrete in formed or core-drilled holes not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of bollard. Fill annular space around bollard solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch (3 mm) toward bollard.

C. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches (75 mm) above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

D. Fill bollards solidly with concrete, mounding top surface to shed water.
   1. Do not fill removable bollards with concrete.

3.5 INSTALLING PIPE GUARDS

A. Provide pipe guards at exposed vertical pipes in parking garage where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inch (19-mm) bolts at each pipe guard. Mount pipe guards with top edge 26 inches (660 mm) above driving surface.

3.6 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

A. Center nosings on tread widths unless otherwise indicated.

B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

C. Seal thresholds exposed to exterior with elastomeric sealant complying with Division 7 Section "Joint Sealants" to provide a watertight installation.

3.7 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 grout.
   1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.
   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.8 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780

3.9 SCHEDULE

A. Provide and install items shown on Drawings with anchorage and attachment necessary for installation. The following Schedule lists principal items only. Refer to drawing details for items not specifically scheduled.

1. Miscellaneous plates or angles not attached to structural steel; complete with anchorage for embedment.
2. Steel pipe columns for supporting frame construction/ millwork
3. Low wall tube steel bracing
4. Steel weld plates and angles for casting into concrete not specified in other Sections.
5. Elevator machine hoist beams
6. Miscellaneous stainless steel base trim.
7. Metal elevator pit ladder.
8. Metal ship's ladder.
9. Metal bollards.
10. Metal angle corner guards.
11. Loose bearing and leveling plates for applications where they are not specified in other Sections.
12. Steel framing and supports for mechanical and electrical equipment.
13. Shelf angles.
14. Other items as indicated on drawings.

- END OF SECTION -

- SECTION 05 5100 -

METAL STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Preassembled steel stairs with fiber reinforce cement treads.
   2. Steel tube railings attached to metal stairs.
   3. Steel tube handrails attached to walls adjacent to metal stairs.

1.3 RELATED SECTIONS

A. Section 05 1200 “Structural Steel”.

B. Section 05 5000 “Metal Fabrications” for ships’ ladder.

C. Section 05 7300 "Decorative Glass Railings" for ornamental metal railings attached to stairs, and tube railings attached to adjacent walls. Work under this section shall be engineered, and fabricated by the same manufacture as the metal stairs.

D. Section 09 2116 "Non-Structural Metal Framing" for metal backing for anchoring railings.

1.4 REFERENCES

A. Standards and References: (Latest Edition unless otherwise noted)
   1. 2001 California Building Code (CBC), Volumes 1, 2, 3
   2. American Society for Testing and Materials (ASTM) Specifications as listed in the Section.
   3. Federal Specifications (FS).
   4. American Institute of Steel Construction’s “Specification for Structural Steel Buildings”.
   5. American Welding Society’s “Structural Welding Code” (AWS D1.1).
   6. American Iron and Steel Institute’s “Specifications for Design of Light Gauge Cold-Formed Stainless Steel Structural Members”.
   7. National Association of Architectural Metal Manufacturer’s “Metal Stairs” (NAAMM-MS).

8. Steel Structures Painting Council's "Painting Manual":
   a. Solvent Cleaning (SSPCC-SP 1).
   b. Hand Tool Cleaning (SSPC-SP 2)
   c. Brush-Off Blast Cleaning (SSPC-SP 7)
   d. Hot Phosphate Surface treatment (SSPC-PT 4).
9. American Hot Dip Galvanizers Association, Inc. (AHDGA):
   a. Inspection manual for hot dip galvanized products.

1.5 PERFORMANCE REQUIREMENTS

A. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
   2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
   3. Uniform and concentrated loads need not be assumed to act concurrently.
   4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
   5. Limit deflection of treads, platforms, and framing members for pre-fabricated stair system to L/240 or 1/4 inch (6.4 mm), whichever is less.
   6. Limit deflection of treads, platforms, and framing members for monumental stair system to L/360 or 1/4 inch (6.4 mm**)**, whichever is less.

B. Structural Performance of Railings: Provide railings as specified under Division 5 "Metal Railing Systems" capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails:
      a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
      b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction 50 lbf/ ft. (0.73 kN/m) applied horizontally and concurrently with 100 lbf/ ft. (1.46 kN/m) applied vertically downward.
      b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   3. Infill of Guards:
   4. Concentrated load of 200 lbf (0.89 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
   5. Uniform load of 25 lbf/sq. ft. (1.2 kN/sq. m) applied horizontally.
   6. Infill load and other loads need not be assumed to act concurrently.

C. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to loads per California Building Code, 2001 Edition.
   1. Coordinate with drawings, see Structural General Notes.

1.6 SUBMITTALS

A. Product Data: For metal stairs and the following:
   1. Prefilled metal-pan stair treads.
   2. Slip-Resistant Fiber-Reinforced Cement.
   3. Abrasive-coated-finish for metal stair treads.
   4. Paint products.

B. LEED Submittal:
   1. Product Data for Credit MR 4.1: Indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content.
      a. Include certification indicating costs for each product having recycled content.
   2. Product Data for Credit EQ 4.2: For paints, including printed statement of VOC content and chemical components.
   3. Local/Regional Materials:
      a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
      b. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
      c. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
      d. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Provide templates for anchors and bolts specified for installation under other Sections.
   2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the California registered professional engineer responsible for their preparation.
   3. Show a large scale construction of various parts, methods of joining, thickness of metals, profiles of surfaces, reinforcing, anchorage, and structural supports. Include information regarding concealed and exposed joints, welds, and fastenings.
   4. Where welded connectors and concrete inserts are required to receive work, show size and locations required.

D. Samples for Initial Selection: For products involving selection of color, texture, or design.

E. Samples for Verification: For the following products, in manufacturer's standard sizes:
   1. Precast concrete treads.
   2. Fiber-reinforced cement-filled stair treads.
   3. Stair treads with nonslip-safety grit surface finish.
   4. Metal floor plate treads.
   5. Grating treads.

F. Welding certificates.

G. Qualification Data: For professional engineer.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for stairs.
1. Test railings according ASTM E 894 and ASTM E 935.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

C. Preassembled Stairs: Commercial class.
1. Ornamental Stairs: Architectural class.
2. Industrial-Type Stairs: Industrial class.

D. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

E. Design Criteria:
1. Work shall be designed to support normally imposed loads and conform to AISC requirements.
2. Built-up parts shall not exhibit warp.

1.8 COORDINATION

A. Coordinate installation of anchorages for metal stairs. 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 concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 METALS, GENERAL

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

2.3 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500 (cold formed), Grade A.

C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

D. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface or with abrasive material metallically bonded to steel by a proprietary process.

1. Available Products:
   a. IKG Industries, a Harsco company; Mebac.
   b. W. S. Molnar Company; SlipNOT.

E. Steel Bars for Grating Treads: ASTM A 36/A 36M.

F. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, structural steel, Grade 25 (Grade 170), unless another grade is required by design loads; exposed elements.

G. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30 (Grade 205), unless another grade is required by design loads.

H. Woven-Wire Mesh: Intermediate-crimp, square pattern, 2-inch (50-mm) woven-wire mesh, made from 0.135-inch (3.5-mm) nominal diameter wire complying with ASTM A 510 (ASTM A 510M).

2.4 FABRICATED TREADS & LANDINGS

A. Prefabricated, non-slip units with safety grit surface permanently bonded to noncombustible fiber reinforced cement board with sheet steel backing.

1. Basis-of-Design Product: The design based on Endura Tread manufactured by American Stairs Romeoville, IL. Tel: (800) 872-7824, www.americanstair.com.

2.5 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

B. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material for Anchors in Exterior Locations: Alloy Group stainless-steel bolts complying with and nuts complying with .

2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

1. Use primer with a VOC content of 250 g/L (2.1 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Dry film thickness: 1.0 – 1.3 mil.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

E. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.

F. Welded Wire Fabric: ASTM A 185, 6 by 6 inches (152 by 152 mm)--W1.4 by W1.4, unless otherwise indicated.

2.7 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.

1. Join components by welding, unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.
3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.

B. Ornamental Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

F. Weld connections 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. Architectural Finish:
      a. Weld exposed corners and seams continuously, unless otherwise indicated.
      b. 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.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

H. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

I. Specialty Fabricated Products:
   1. Preparation:
      a. Coordinate with other work supporting or adjoining miscellaneous metal and verify requirements for cutting out, fitting, and attaching.
      b. Verify sizes, designs, and locations of items; do so at site whenever construction progress permits.
   2. General Requirements:
      a. Fabricate items from materials noted and make true to profiles shown. Obtain the Architect's approval of proposed variations.
      b. Miter corners and angles of frames and moldings unless otherwise noted.
      c. Perform cutting, shearing, drilling, punching, threading, tapping as required for items or their adjacent work.
      d. Drill or punch holes; do not use cutting torch.
      e. Ensure shearing and punching leaves true lines and surfaces.
      f. Items to be Galvanized: Fabricate in accordance with recommended practices of ASTM A385 and A386 unless specifically noted otherwise.
      g. Fabricate exterior items for assembly and installation on site without field-welding of joint.
      h. Ensure metal thickness and assembly details provide ample strength and stiffness.
      i. Size sleeves for approximately 1/4-inch clearance all around.

3. Fastening:
   a. Provide fasteners and anchor assemblies required for complete fabrication, field assembly, and erection.
   b. Conceal fastenings wherever practicable.
   c. Size internally threaded diameters to accommodate galvanized threaded bolts where galvanizing is required.
   d. Permanent connections in Ferrous Metal Items: Employ welding wherever practicable; avoid bolts and screws.
4. Welding:
   a. Use electric shielded-arc process according to AWS D1.1.
   b. Maintain shape and profile of item welded.
   c. Prevent heat blisters, run-throughs, and surface distortions.
   d. Welds Normally Exposed to View in Finished Work: Make uniform and grind smooth.

2.8 STEEL-FRAMED STAIRS

A. Stair Framing:
   1. Fabricate stringers of steel tubes.
      a. Provide closures for exposed ends of tube stringers.
   2. Construct platforms of steel tube headers and miscellaneous framing members as needed to comply with performance requirements.
   3. Weld stringers to headers; weld framing members to stringers and headers.
   4. Where stairs are enclosed by gypsum board shaft-wall assemblies, provide hanger rods or struts to support landings from floor construction above or below, unless otherwise indicated on drawings. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
   5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

B. Slip-Resistant Fiber-Reinforced Cement: Slip-resistant safety grit permanently bonded to fiber-reinforced cement treat with sheet steel backing, factory-welded to stringers.
   1. Slip Resistance: Not less than 70 transverse per ASTM E 303.
   2. Product: Endura Smooth Surface Tread as manufactured by American Stair Corporation.
   3. Tread Protective Cover: Factory attached 7/16” OSB exterior grade.
   4. Endura Safety Tread with “Glow-In-The-Dark” factory applied nose striped, will illuminate for up to 4 hours after removal of artificial light.

C. Abrasive-Coating-Finished, Formed-Metal Stairs: Form risers, treads, and platforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.0966 inch (2.5 mm).
   1. Steel Sheet: Uncoated hot-rolled steel sheet, unless otherwise indicated.
   2. Directly weld risers and treads to stringers; locate welds on underside of stairs.
   3. Provide platforms of configuration indicated or, if not indicated, the same as treads. Weld platforms to platform framing.
   4. Finish tread and platform surfaces with manufacturer's standard epoxy-bonded abrasive finish.

2.9 STEEL TUBE RAILINGS

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.

1. Configuration: 1-1/2-inch- (38-mm-) square top and bottom rails and posts with infill panels made from woven wire mesh crimped into 1-by-1/2-by-1/8-inch (25-by-13-by-3-mm) steel channel frames.
   a. Premium woven wire mesh, 2-inch by 2-inch pattern.
   b. Orient wire mesh with wires perpendicular and parallel to top rail.

B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

C. Form changes in direction of railings as follows:

1. As detailed.
2. By bending or by inserting prefabricated elbow fittings.
3. By inserting prefabricated elbow fittings.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of railing members with prefabricated end fittings.

F. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

1. Connect posts to stair framing by direct welding, unless otherwise indicated.
2. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.10 FINISHES

A. Preparation of Surfaces:

1. Thoroughly clean mill scale, rust, dirt, grease, and other foreign matter from ferrous metal prior to galvanizing, hot phosphate treatment or painting.
2. Where hand cleaning methods are not adequate, clean in accordance with SSPC-SP 1, SSPC-SP 2, or SSPC-SP 7 as required.

3. Completely eliminate burrs, rough spots and pitting from normally exposed ferrous metal items.

B. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:
   1. Exterior Stairs (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Interior Stairs (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

D. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

E. Finish metal stairs after assembly.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Examine areas to receive work and verify that: Setting conditions and dimensions are correct to receive items.

B. Do not start installation until unsatisfactory conditions have been corrected.

C. Install work plumb, true, rigid, and neatly trimmed out.

D. Do not tighten fastener through finish alone without spacer washers.

E. Provide concrete inserts or predrilled expansion bolts in fastening items into concrete.

F. Protect dissimilar metals from contact with each other or with other materials causing corrosion.

G. Fasten work tightly to prevent rattle or vibration except where expansion-contraction tolerances are required.

H. Use nonshrink grout mixed in accordance with manufacturer’s direction for setting frames, plates, sills, bolts and similar items.

I. Set items shown or required to be installed in sleeves with quick-setting anchor cement unless otherwise noted.

J. Protect metal from damage to surface, profile and shape.

K. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

L. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

M. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.

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

O. 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.

P. 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.

Q. Place and finish concrete fill for treads and platforms to comply with Division 3 Section "Cast-in-Place Concrete."

1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.

3.2 INSTALLING METAL STAIRS WITH GROUTED BASE PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of baseplates.

1. Remove protective devices only when items will be safe from other construction operations or removal is required to permit related work.
2. Clean prime-coated items as required for finish painting.

B. Set steel stair baseplates on wedges, shims, or leveling nuts. After stairs have been positioned and aligned, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonmetallic, nonshrink grout, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING STEEL TUBE RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

1. Anchor posts to steel by welding directly to steel supporting members.

2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.

B. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
3. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.4 ADJUSTING AND CLEANING

A. Touchup: Immediately after erection, 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.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Painting: Cleaning and painting of metal stair system are specified in Division 9 “High Performance Painting” section.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780

- END OF SECTION -

- SECTION 05 5213 -

PIPE & TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Steel plate and tube guardrail systems.
   2. Steel pipe and tube hand stair railings.
   3. Work under this shall be engineered, and fabricated by the same source as the work described under Section 05 5100 “Metal Stairs”.

1.3 RELATED SECTIONS

A. Section 05 5100 "Metal Stairs" for ornamental prefabricated metal stairs.

B. Section 05 7300 “Decorative Glass Railings” for ornamental metal railings and guardrails with glass and metal infill panels.

C. Section 09 2216 "Non-Structural Metal Framing" for metal backing for anchoring railings.

D. Section 09 9600 “High Performance Coatings” for field applied durable paint finish.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails:
      a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
      b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
      b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.

3. Infill of Guards:
   a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
   b. Uniform load of 25 lbf/sq. ft. (1.2 kN/sq. m) applied horizontally.
   c. Infill load and other loads need not be assumed to act concurrently.

1.5 SUBMITTALS

A. Product Data: For the following:
   1. Grout, anchoring cement, and paint products.

B. LEED Submittal:
   1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
      a. Include certification indicating costs for each product having recycled content.
   2. Product Data for Credit EQ 4.2: For paints, including printed statement of VOC content and chemical components.
   3. Local/Regional Materials:
      a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
      b. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
      c. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.
      d. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Samples for Verification: For each type of wood finish required.
   1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
   2. Fittings and brackets.

E. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

F. Welding certificates.

G. Qualification Data: For professional engineer.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing component through one source from a single manufacturer.

B. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. 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 concrete or masonry. Deliver such items to Project site in time for installation.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Steel Pipe and Tube Railings:
      a. Pisor Industries, Inc.
      b. Sharpe Products.
      c. Wagner, R & B, Inc.; a division of the Wagner Companies.

B. At contractor’s option: Railing systems may be fully fabricated by a qualified metal shop meeting the requirements of this section.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.3 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.4 FASTENERS

A. General: Provide the following:
   1. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:
   1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

D. Anchors: Provide cast-in-place chemical or torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
   1. Use primer with a VOC content of 250 g/L (2.1 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
      b. Carboline Company; Carbozinc 621.
      c. ICI Devoe Coatings; Catha-Coat 313.
      d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
      e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
      f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
      g. Tnemec Company, Inc.; Tneme-Zinc 90-97.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with either welded or nonwelded connections, unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
   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 flux immediately.
   4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

J. Form changes in direction as follows:
   1. By bending or by inserting prefabricated elbow fittings.
   2. By inserting prefabricated elbow fittings.

K. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of railing members with prefabricated end fittings.

M. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

P. For railing posts set in concrete, provide steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with steel plate forming bottom closure.

Q. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate a continuous 2-inch high by 1-1/2-inch deep toe board along all stair landings and balcony edges.

2.7 STEEL AND IRON FINISHES

A. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed railings:

1. Interior Railings Indicated to Receive Zinc-Rich Primer (SSPC Zone 1A): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.

3.4 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Cover anchorage joint with flange of same metal as post, attached to post with set screws, at enclosed stairwells.

C. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch (3-mm) buildup, sloped away from post.

D. Anchor plate balusters to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3.5 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface.

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets to building construction as follows:

1. For steel-framed gypsum board partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.

3.6 ADJUSTING AND CLEANING

A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

3.7 PROTECTION

A. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

B.

- END OF SECTION -

- SECTION 05 5300 -

METAL GRATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Metal bar gratings, exterior.
   2. Metal frames and supports for gratings.

1.3 RELATED SECTIONS

A. Section 03 3000 “Cast-in-Place Concrete” for coordination with embeds and recessed grating frames.

B. Section 05 1200 "Structural Steel" for structural-steel framing system components.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Metal bar gratings.
   2. Clips and anchorage devices for gratings.

B. LEED Submittal:
   1. Product Data for Credit MR 4.1 : For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
      a. Include certification indicating costs for each product having recycled content.
   2. Product Data for Credit EQ 4.2: For paints, including printed statement of VOC content and chemical components.
   3. Local/Regional Materials:
      a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
      b. Manufacturing location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.

c. Product Value: Indicate dollar value of product containing local/regional materials; include materials cost only.

d. Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.

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

1. Provide templates for anchors and bolts specified for installation under other Sections.

D. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

1.5 QUALITY ASSURANCE

A. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual and NAAMM MBG 532, "Heavy-Duty Metal Bar Grating Manual."

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating gratings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

A. Coordinate installation of anchorages for gratings, grating frames, and supports. 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 concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Metal Bar Gratings:

a. Alabama Metal Industries Corporation.
b. All American Grating, Inc.
c. Barnett/Bates Corp.
d. Borden Metal Products (Canada) Limited.
e. Fisher & Ludlow.
f. Grupo Metelmex, S.A. de C.V.
g. IKG Industries; a Harsco Company.
h. Marwas Steel Co.; Laurel Steel Products Division.
i. Ohio Gratings, Inc.
j. Seidelhuber Metal Products, Inc.
k. Tru-Weld.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Wire Rod for Grating Crossbars: ASTM A 510 (ASTM A 510M).

C. Uncoated Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30 (Grade 205).

D. Galvanized Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group 2 (A4).

D. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

E. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

F. Anchors: Provide cast-in-place or torque-controlled expansion anchors with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

2. Material for Anchors in Exterior Locations: Alloy Group 2 (A4) stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy that is welded.

B. Zinc-Rich Primer: Zinc-rich primer, complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Use primer with a VOC content of 250 g/L (2.1 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
3. Products: Subject to compliance with requirements, provide one of the following:
   a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
   b. Carboline Company; Carbozinc 621.
   c. ICI Devoe Coatings; Catha-Coat 313.
   d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
   e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
   f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
   g. Tnemec Company, Inc.; Tneme-Zinc 90-97.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION

A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.

D. Fit exposed connections accurately together to form hairline joints.

E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.

2.6 METAL BAR GRATINGS

A. Pressure-Locked Steel Grating: Fabricated by either pressing rectangular flush-top crossbars into slotted bearing bars or swaging crossbars between bearing bars.

1. Grating Mark P-15-4 (1-1/4 x 1/8) STEEL: 1-1/4-by-1/8-inch (32-by-3.2-mm) bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
2. Traffic Surface: Plain.
3. Steel Finish: Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface.

B. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.

1. Provide not less than four weld lugs for each heavy-duty grating section, with each lug shop welded to two bearing bars.
2. Provide not less than 4 saddle clips for each grating section composed of rectangular bearing bars 3/16 inch (4.8 mm) or less in thickness and spaced 15/16 inch (24 mm) or more o.c., with each clip designed and fabricated to fit over 2 bearing bars.
3. Furnish galvanized malleable-iron flange clamp with galvanized bolt for securing grating to supports. Furnish as a system designed to be installed from above grating by one person.
    a. Available Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to, "Grate-Fast" by Lindapter North America, Inc.
    b. Product: Subject to compliance with requirements, provide "Grate-Fast" by Lindapter North America, Inc.

C. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.

1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.

D. Do not notch bearing bars at supports to maintain elevation.

2.7 GRATING FRAMES AND SUPPORTS

A. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

1. Unless otherwise indicated, fabricate from same basic metal as gratings.
2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches (600 mm) o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long.

B. Galvanize steel frames and supports in the following locations:

1. Exterior.

2.8 STEEL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish gratings, frames, and supports after assembly.

C. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with ASTM A 123/A 123M.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.

D. Fit exposed connections accurately together to form hairline joints.

3.2 INSTALLING METAL BAR GRATINGS

A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.

B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.3 ADJUSTING AND CLEANING

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

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780

- END OF SECTION -

- SECTION 05 7300 -

DECORATIVE GLASS RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Tempered glass railing assemblies at interior stairs.

1.3 RELATED SECTIONS

A. Section 08 8000 “Glazing” for tempered glazing.

1.4 REFERENCES

A. ASTM A 666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

B. ASTM B 221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

C. ASTM B 248 – Standard Specification for General Requirement for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar.

D. ASTM B 633 – Standard Specification for Normalized High-Strength Low-Alloy Structural Steel Plates.

E. ASTM C 595 – Standard Specification for Blended Hydraulic Cements.

F. ASTM C 1048 – Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.

G. ASTM E 488 – Standard Test Method for Strength of Anchors in Concrete and Masonry Element.

H. AWS D1.1 – Structural Welding Code-Steel.

I. SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning.

1.5 PERFORMANCE REQUIREMENTS

A. Structural Performance: Systems shall comply with California Building Code, including Chapters 10, 11B and 24, Sections 2406.4 and 2406.6. Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrail Assembly:
   a. Distributed load of 50-lbs per sq. ft. applied horizontally at right angles to the handrail.
   b. Concentrated horizontal load of 200-lbs applied in any direction at any point along handrail system.
   c. Distributed loads and concentrated loads not to be applied simultaneously.

1.6 SUBMITTALS

A. Product Data: For expansion cement and fasteners.

B. LEED Submittals:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

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

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by a civil engineer licensed in the State of California responsible for their preparation.

D. Samples for Verification:

1. Sections of each distinctly different linear railing member, including handrails, top rails, and posts.
2. Fittings and brackets.

E. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

F. Welding certificates.

G. Qualification Data: For civil engineer.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing component through one source from a single manufacturer.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code-Steel."

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. 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 concrete or masonry. Deliver such items to project site in time for installation.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Tempered Glass Railing Assemblies:
1. P & P Artec, Dale, IL.
2. Blumcraft.
3. Livers Bronze Co.
4. Or equal.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.3 MATERIALS, GENERAL

A. Stainless Steel: ASTM A 666, Type 304.

2.4 COMPONENTS

A. Handrails: 304 stainless steel pipe, 1-1/2-inch diameter with a 360-400 grit finish.

B. Balusters: One single baluster post, 304 stainless steel pipe 1-1/4-inch O.D. with a 360-400 grit finish.

C. Frame Tubes: Hard drawn stainless steel tube 5/8-inch O.D. with a 360-400 grit finish.

D. Connection Fittings: Solid cast zinc, powder coated, color as selected by Architect.

E. In-fill Panel Glazing: Fully tempered ASTM C 1048 Kind FT, Quality q3. As specified in Section 08 8000.
   1. Thickness: 5/16-inch, all four sided polished.
   2. Color: As selected.

F. Bolts, Screws and Nuts: 304 Stainless steel. Do not use metals that will be corrosive and incompatible with materials being fastened.

G. Mixes: Red Head Ceramic 6 Epoxy to cast baluster into concrete.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32-inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

F. Connections: Fabricate railings with either welded or nonwelded connections, unless otherwise indicated.

G. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
   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 flux immediately.
   4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

H. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

I. Form changes in direction as follows:
   1. By bending or by inserting prefabricated elbow fittings.
   2. By inserting prefabricated elbow fittings.

J. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Close exposed ends of railing members with prefabricated end fittings.

L. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4-inch or less.

M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.
   1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

O. Mounting of railing system: Side mount with baluster foot.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
   1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
   2. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4-inch in 12-feet.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.

3.4 ATTACHING HANDRAILS TO GLASS / GLAZING

A. Attach handrails to glazing with concealed surface mounted hand railing bracket. Provide brackets with 1-1/2-inch minimum clearance from inside face of handrail and finished wall surface.

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

3.5 ADJUSTING AND CLEANING

A. Clean stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

3.6 PROTECTION

A. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

- END OF SECTION -

DIVISION 06 – WOODS & PLASTICS

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- SECTION 06 1053 -

MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Wood blocking and nailers.
   2. Plywood backing panels.

1.3 RELATED SECTIONS

A. Section 06 4023 "Interior Architectural Woodwork" for nonstructural carpentry items exposed to view and not specified in another section.

1.4 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. NeLMA: Northeastern Lumber Manufacturers' Association.
   2. NHLA: National Hardwood Lumber Association.
   3. NLGA: National Lumber Grades Authority.
   4. SPIB: The Southern Pine Inspection Bureau.
   5. WCLIB: West Coast Lumber Inspection Bureau.
   6. WWPA: Western Wood Products Association.

1.5 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments specified to be High-Temperature (HT) type include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. LEED Submittals:
1. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.
2. Product Data for Credit EQ 4.4: For composite-wood products, documentation indicating that product contains no urea formaldehyde.
3. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.

C. Include statement indicating costs for each certified wood product.

D. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Powder-actuated fasteners.
5. Expansion anchors.
6. Metal framing anchors.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

B. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

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, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded 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, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS (PT)

A. Preservative Treatment by Pressure Process: AWPA C2, except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPA C31 with inorganic boron (SBX).

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

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

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

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

1. Wood blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood blocking and similar concealed members in contact with masonry or concrete.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood).
   1. Use treatment that does not promote corrosion of metal fasteners.
   2. Use Exterior type for exterior locations and where indicated.
   3. Use Interior Type A, High Temperature (HT) for enclosed roof framing, framing in attic spaces, and where indicated.
   4. Use Interior Type A, unless otherwise indicated.

B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
   1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

C. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

D. Application: Treat items indicated on Drawings, and the following:
   1. Concealed blocking.
   2. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any of the following species:.
   1. Hem-fir (north); NLGA.
   2. Spruce-pine-fir; NLGA.
   3. Hem-fir; WCLIB, or WWPA.
   4. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
   5. Western woods; WCLIB or WWPA.

C. For blocking not used for attachment of other construction Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
   1. Where 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 A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

G. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
   1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
   2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

2.7 METAL FRAMING ANCHORS

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

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cleveland Steel Specialty Co.
   2. Harlen Metal Products, Inc.
   3. KC Metals Products, Inc.
   4. Simpson Strong-Tie Co., Inc.
   5. Southeastern Metals Manufacturing Co., Inc.

6. USP Structural Connectors.

C. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
   1. Use for interior locations where stainless steel is not indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions.

D. Do not splice structural members between supports, unless otherwise indicated.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
   1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
   1. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal- (38-mm actual-) thickness.

G. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
   1. Use inorganic boron for items that are continuously protected from liquid water.
   2. Use copper naphthenate for items not continuously protected from liquid water.

I. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.

2. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's Uniform Building Code.

J. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.3 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

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

- END OF SECTION -

- SECTION 06 1600 -

SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Wall sheathing.
   2. Parapet sheathing.
   3. Building paper.
   4. Sheathing joint-and-penetration treatment.
   5. Flexible flashing at openings in sheathing.

1.3 RELATED SECTIONS

A. Section 05 4000 “Cold Formed Metal Framing" for exterior framed walls

B. Section 06 1053 "Miscellaneous Rough Carpentry" for plywood backing panels.

C. Section 09 2400 “Portland Cement Plastering” for metal lath installation over exterior wall sheathing.

1.4 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
   3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

4. For building wrap, include data on air-/moisture-infiltration protection based on testing according to referenced standards.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
1. Preservative-treated plywood.
2. Fire-retardant-treated plywood.
3. Foam-plastic sheathing.
4. Building wrap.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS, GENERAL

A. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.

B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

C. Factory mark panels to indicate compliance with applicable standard.

2.2 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA C9.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.3 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
1. Product: Subject to compliance with requirements, provide “Dens-Glass Gold” and "Dens-Glass Gold Fireguard" by G-P Gypsum Corporation.
2. Type and Thickness:
a. Regular, **1/2 inch (13 mm).**
b. Type X, 5/8 inch (15.9 mm) thick.
3. Size: 48 by 96 inches (1219 by 2438 mm) for vertical installation.

B. Plywood Roof Nailers: Exterior, Structural I sheathing.
1. Span Rating: Not less than 32/16.
2. Nominal Thickness: Not less than 1/2 inch (13 mm).

2.4 PARAPET SHEATHING

A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 5/8 inch (16 mm) thick for installation on the inside face of parapet walls.
1. Products: Subject to compliance with requirements, provide the following:
a. Georgia-Pacific Corporation; Dens Deck.

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 wall sheathing, provide fasteners of Type 304 stainless steel.
2. For roof and parapet sheathing, provide fasteners of Type 304 stainless steel and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck and framing.

B. Power-Driven Fasteners: NES NER-272.

C. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
1. For steel framing less than 0.0329 inch (0.835 mm) thick, attach sheathing to comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, attach sheathing to comply with ASTM C 954.

2.6 WEATHER-RESISTANT SHEATHING PAPER

A. Building Wrap: ASTM E 1677, Type I air retarder; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:
   a. Dow Chemical Company (The); Styrofoam Weatherrmate Plus Brand Housewrap.
   b. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap.
3. Water-Vapor Permeance: Not less than 125 g through 1 sq. m of surface in 24 hours per ASTM E 96, Desiccant Method (Procedure A).
4. Allowable UV Exposure Time: Not less than three months.

B. Building Paper: UBC Standard 14-1, Grade D (water-vapor-permeable, kraft building paper), except that water resistance shall be not less than 1 hour and water-vapor transmission shall be not less than 75 g/sq. m x 24 h.

C. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.7 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Paper-Surfaced Glass-Mat Gypsum Sheathing Board: Silicone emulsion sealant complying with ASTM C 834, 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.

B. Sheathing Tape for Glass-Mat Gypsum Sheathing Board: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board and with a history of successful in-service use.

2.8 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.
1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch (1.0 mm).
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
   b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor Plus Self-Adhered Flashing.
   c. MFM Building Products Corp.; Window Wrap.
   d. Polyguard Products, Inc.; Polyguard 300.
   e. Protecto Wrap Company; BT-20 XL.

C. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

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.

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. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's "Uniform Building Code."
4. Table 2305.2, "Fastening Schedule," in BOCA's "BOCA National Building Code."
5. Table 2306.1, "Fastening Schedule," in SBCCI's "Standard Building Code."
6. 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."
7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's "International One- and Two-Family Dwelling Code."

D. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall 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.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
1. Fasten gypsum sheathing to wood framing with screws.
2. Fasten gypsum sheathing to cold-formed metal framing with screws.
3. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.

4. Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry, concrete or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.
2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.
2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

3.3 WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION

A. General: Cover sheathing with weather-resistant sheathing paper as follows:

1. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.
2. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap, unless otherwise indicated.

B. Building Paper: Apply horizontally with a 2-inch (50-mm) overlap and a 6-inch (150-mm) end lap; fasten to sheathing with galvanized staples or roofing nails.

C. Building Wrap: Comply with manufacturer's written instructions.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

3.4 SHEATHING JOINT-AND-PENETRATION TREATMENT

A. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient quantity 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 board joints, and apply and trowel silicone emulsion 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.
3. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

3.5 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturers written instructions.
1. Prime substrates as recommended by flashing manufacturer.
2. Lap seams and junctures with other materials at least 4 inches (100 mm), except that at flashing flanges of other construction, laps need not exceed flange width.
3. Lap flashing over weather-resistant building paper at bottom and sides of openings.
4. Lap weather-resistant building paper over flashing at heads of openings.
5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

3.6 PROTECTION

A. Paper-Surfaced Gypsum Sheathing: Protect sheathing by covering exposed exterior surface of sheathing with weather-resistant sheathing paper securely fastened to framing. Apply covering immediately after sheathing is installed.

- END OF SECTION -

- SECTION 06 4023 -

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Interior standing and running trim.
   2. Plastic-laminate cabinets.
   3. Plastic-laminate countertops.
   4. Phenolic laboratory tops.
   5. Plastic-laminate shelving.
   6. Shop finishing of interior woodwork.

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.

1.4 RELATED SECTIONS

A. Section 06 1053 “Miscellaneous Rough Carpentry” for blocking to attach millwork and shelving.

B. Section 06 6500 “Solid Polymer Fabrications” for solid surfacing materials and countertops.

C. Section 12 3640 “Stone Countertops” for stone countertops.

D. Section 12 3200 “Manufactured Wood Casework” for modular wood cabinets.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated, including cabinet hardware and accessories, and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

C. Samples for Verification: For the following:
   1. Veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork.
   2. Veneer-faced panel products with or for transparent finish, 12 by 24 inches (300 by 600 mm), for each species and cut. Include at least one face-veneer seam and finish as specified.
   3. Plastic-laminate-clad panel products, 8 by 10 inches, for each type, color, pattern, and surface finish.
   4. Thermoset decorative-panels, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with edge banding on 1 edge.
   5. Corner pieces as follows:
      a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches (450 mm) high by 18 inches (450 mm) wide by 6 inches (150 mm) deep.

D. LEED Submittals:
   1. Product Data for Credit EQ 4.1: For installation adhesives, including printed statement of VOC content.
   2. Product Data for Credit EQ 4.4:
      a. For each composite-wood product used, documentation indicating that the bonding agent contains no urea formaldehyde.
      b. For each adhesive used, documentation indicating that the adhesive contains no urea formaldehyde.
   3. Product Data for Credit(s) MR 4.1 and MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content
      a. Include statement indicating costs for each product having recycled content.
   4. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.
      a. Include statement indicating costs for each certified wood product.

E. Product Certificates: Signed by manufacturers of woodwork certifying that products furnished comply with requirements.

F. Woodwork Quality Standard Compliance Certificates: WI-certified compliance certificates.

G. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.6 QUALITY ASSURANCE

A. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production and installation of interior architectural woodwork.

B. Industry Standards:
   1. Casework construction and installation shall meet or exceed minimum requirements of Woodwork Institute (WI) – Manual of Millwork, eleventh edition except as otherwise specified herein.
   2. Casework construction and installation details shall comply with standard WI details and applicable seismic criteria of California Building Code (CBC).
   3. Issue WI Certified Compliance Certificate after fabrication and prior to shipping casework to work site.
      a. Each unit of casework shall bear the WI Certificate Compliance Label.
      b. Each countertop shall the bear the WI Certificate Compliance Label.

C. Millwork specified shall be manufactured in accordance with the standards established in the Manual of Millwork of the Woodwork Institute of California, current edition, in the grade or grades hereinafter specified or as shown on the drawings. If the manufacturer of millwork is not a WIC licensee, Contractor shall furnish to Architect, prior to installation, a Certificate of Reinspection by the WIC indicating that the millwork in question meets the requirements of the WIC grade specified. If the manufacturer of millwork is a WIC licensee, each unit of millwork shall bear the WIC Certified Compliance grade stamp indicating the grade specified, and by the completion of the job WIC Certified Compliance Certificates shall be provided indicating the grade specified. The foregoing shall not be construed to limit the power and authority of Architect to reject millwork which does not, in Architect's opinion, meet with any one or more of the specifications of the contract.

D. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers.

E. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

F. Forest Certification: Provide interior architectural woodwork produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and will maintaining temperature between 60 and 90 deg F and relative humidity between 17 and 50 percent during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.

1.9 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of the WI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Species and Cut for Transparent Finish: TBD, plain sliced.

C. Wood Products: Comply with the following:

1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2.
3. Particleboard: ANSI A208.1.
4. Softwood Plywood: DOC PS 1.
5. Hardwood Plywood and Face Veneers: HPVA HP-1.

D. Thermoset Decorative Overlay: Particleboard complying with ANSI A208.1, Grade M-2, or medium-density fiberboard complying with ANSI A208.2, Grade MD, with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.

1. Basis-of-Design Product: The District's Standard is based on Pionite: Pioneer Plastics Corp., Auburn, ME 207.784.9111 or 800.777.8113, NO SUBSTITUTIONS ALLOWED.

F. Phenolic Composite: Solid, high-pressure decorative laminate, complying with NEMA LD 3, Grade CGS.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Arborite; a division of ITW Canada.
   b. Epoxyn Products.
   c. Formica Corporation.
   d. Nevamar Company, LLC.
   e. NuLab Furniture Corporation.
   f. Panolam Industries International Incorporated; Pionite Decorative Surfaces.
   g. Trespa North America.
2. Chemical Resistance: Composite countertop material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
   a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), ethyl acetate, ethyl alcohol, formaldehyde (37 percent), furfural, nitric acid (30 percent), phosphoric acid (85 percent), sodium hydroxide (20 percent), sulfuric acid (33 percent), toluene,.
   b. Color: As selected by Architect from manufacturer's full range.

G. Adhesive for Bonding Plastic Laminate: Contact cement, for general use and for postforming. Use unpigmented product with through-color laminate.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

H. Tempered Float Glass for Cabinet Doors: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3, 6 mm thick, unless otherwise indicated.

I. Mirror Glass for Cabinet back: ASTM C 1503, Mirror Select, Quality-Q3, 6.0 mm thick.

J. Tempered Float Glass for Cabinet Shelves: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3; with exposed edges seamed before tempering, 6 mm thick.

2.2 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, provide materials that comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood), exterior type.

1. Fire-Retardant Chemicals: Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.

2. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
3. Kiln-dry materials before and after treatment to levels required for untreated materials.
4. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
5. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

2.3 INSTALLATION MATERIALS

A. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Provide premium grade interior woodwork complying with the referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
   1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.
   2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.

D. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
   2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

E. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.5 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. General: Comply with referenced Woodworking Institute (WI)'s "Manual of Millwork quality standard's requirements for factory finishing."

B. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building, unless otherwise indicated.

C. Grade: Custom.

D. Heights: As indicated on Drawings.

E. Finish wood veneered wall panels and trim off-site in a controlled environment.

F. Transparent Finish: Comply with requirements indicated for grade, finish system, staining effect, and sheen.
   1. Grade: Premium.
   2. Finish: WI System #8 UV curable coating.
   3. Effect: Open-grain finish.
   4. Sheen: Satin.

G. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.

H. Assemble casings in plant except where limitations of access to place of installation require field assembly.

2.6 PLASTIC-LAMINATE CABINETS

A. Grade: Premium.

B. WI Construction Style: Style A, Frameless.

C. WI Construction Type: Type I, multiple self-supporting units rigidly joined together.

D. WI Door and Drawer Front Style: Flush overlay.

E. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
   1. Horizontal Surfaces Other Than Tops: Grade HGS.
   2. Postformed Surfaces: Grade HGP.
   3. Vertical Surfaces: Grade VGS.
   4. Edges: Same as laminate cladding on horizontal surfaces.

F. Materials for Semiexposed Surfaces:
   1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
      a. Edges of Plastic-Laminate Shelves: Same as laminate cladding on horizontal surfaces.

b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade CLS. Color selected by Architect.

2. Drawer Sides and Backs: Solid-hardwood lumber.

3. Drawer Bottoms: Thermoset decorative panels.

G. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

H. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. Match Architect's sample, unless otherwise noted on drawings.

I. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

2.7 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets provided under this Section.

B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.

C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing.

D. Door and Drawer Pulls: Hafele Cat. No. 115.61.601, 4-inch center or equal by Builders Brass Works No., Quality, Stanley or approved equal, satin stainless steel.

E. Shelf Rests: BHMA A156.9, B04013.

F. Brush and Extrusion Wire Manager: Doug Mocket & Company BREXT2 – 2” brush grommet and plastic extrusion cut and mitered to fit. Color: Matte Black

G. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091, similar those manufactured by Accuride International Inc, and Grant Hardware Co., rated for the following loads:

1. Typical drawers, full extension, 150 lb. Capacity: Accuride 4032.

2. Heavy drawers, overtravel design, 150 lb. Capacity: Accuride 4034 Series.

3. Shallow drawers, full extension, low profile, 65 lb. Capacity: Accuride 2632.

4. File drawers, 1-inch overtravel, 200 lb. Capacity, three-section slide, 0.63 inch slide space: Accuride 4337.

H. Cabinet drawer/door locks: Best/Stanley 5E6, pin tumbler operation, re-keyable and capable of being master keyed. Wafer tumbler locks will not be acceptable.

1. Provide locks at all drawers, single doors and on active leaf of paired doors.

2. Provide 2 keys for each lock.

3. Coordinate locks and latches specified below. At pairs of doors, active leaf shall have lock and inactive leaf shall have elbow catch.

4. Keying: Assist Owner with developing a key schedule for drawer locks when shop drawings are reviewed. Coordinate with keying requirements specified in Section 08 7111 “Door Hardware”.

I. Grommets for Cable Passage through Countertops: 3-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage except as noted otherwise. Color to be selected by the Architect for manufactures standard colors.

1. Manufacture: Outwater Plastic Industries, Inc or approved equal.

J. Casework Hardware Finish: ANSI/BHMA A 156.18.

1. Exposed hardware: Chrome plated or stainless steel, brushed finish, as follows:
   a. Chrome, satin brushed finish, plated on steel: BHMA 652 (US26D)
   b. Chrome, satin brushed finish, plated on brass or bronze: BHMA 626 (US26D).
   c. Stainless steel, brushed: BHMA 630 (US32D).
2. Concealed hardware: Polished or satin chrome or brushed stainless steel.

K. Label Holders: Stainless steel, aluminum, or chrome plated; sized to receive commercially available, standard office type name badges (e.g. Avery 74552 – 2 inch x 3 inch (51 by 76 mm) Name Badges) that can be printed using standard office computer applications (e.g. Microsoft Word) and standard office printers, attached with screws or rivets. Provide on all casework doors and drawers.

2.8 PLASTIC-LAMINATE COUNTERTOPS

A. Quality Standard: Comply with Woodwork Institute (WI) Manual of Woodwork requirements for high-pressure decorative laminate countertops.

B. Grade: Custom.

C. High-Pressure Decorative Laminate Grade: HGS (horizontal surfaces) and HGP (postformed).

D. Colors, Patterns, and Finishes: Refer to Drawings.

E. Edge Treatment: Same as laminate cladding on horizontal surfaces.

F. Core Material: Fire-treated plywood.

G. Core Material at Sinks: Fire-treated plywood made with exterior glue.

2.9 LAMINATED-PLASTIC LABORATORY TOPS

A. Grade: Custom.

B. High-Pressure Decorative Laminate: Chemical-resistant, Grade HGP.

C. Colors and Patterns: Provide materials and products that result in colors and patterns of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from manufacturer's full range of colors and patterns.

D. Core Material: Fire-treated plywood

2.10 PLASTIC-LAMINATE SHELVING

A. Grade: Custom.

B. WI Construction Style: Style A, Frameless.

C. WI Construction Type: Type I, multiple self-supporting units rigidly joined together.

D. WI Door Front Style: Flush overlay.

E. Reveal Dimension: 1/2 inch (13 mm).

F. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
   1. Horizontal Surfaces Other Than Tops: Grade HGS.
   2. Postformed Surfaces: Grade HGP.
   3. Vertical Surfaces: Grade VGS.
   4. Edges: PVC T-mold matching laminate in color, pattern, and finish.

G. Materials for Semiexposed Surfaces:
   1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
      a. Edges of Plastic-Laminate Shelves: PVC T-mold matching laminate in color, pattern, and finish.
      b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade CLS.

H. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

I. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   1. Nevamar Corp., Color: As indicated on Drawings.

J. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

2.11 SHOP FINISHING

A. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
   1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative overlay.

C. Transparent Finish:
   1. Grade: Premium.
   2. WI Finish System 3b.: Catalyzed vinyl lacquer.
   3. Staining: Match Architect's sample.
   4. Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
   5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
   6. Filled Finish for Open-Grain Woods: After staining (if any), apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.
      a. Apply wash-coat sealer after staining and before filling.

D. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and back-priming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.

E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

G. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 60 inches long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base, if finished.
2. Install wall railings on indicated metal brackets securely fastened to wall framing.
3. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

H. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.
3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

I. Wood Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.

J. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
3. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
4. Calk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

K. Complete the finishing work specified in this Section to extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in shop.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

- END OF SECTION -

- SECTION 06 6400 -

FIBERGLASS REINFORCED PLASTIC WALL PANELS (FRP)

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. Shop Drawings: Show location and dimension of joints and fastener attachments.

B. Product Data: Manufacturer's Specifications and installation instructions for each material and accessory.

C. Submit specified color and texture sample of wall panel and trim pieces for verification.

D. Submit cleaning and maintenance instructions.

1.3 SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content and chemical components.
2. Product Data for Credit EQ 4.4: For laminating adhesive and composite wood products used in factory-laminated plastic panels, indicating that product contains no urea formaldehyde.

C. Samples for Initial Selection: For plastic paneling and trim accessories.

D. Samples for Verification: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 QUALITY ASSURANCE

A. Provide panels and accessories by one manufacturer to ensure warranty and color match.

B. ASTM International:
   1. ASTM D2583 Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
   2. ASTM D5319 Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
   3. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.

1.5 SYSTEM DESCRIPTION

A. Performance Requirements: Provide fiberglass reinforced plastic (FRP) panels which have been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

1.6 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide wall panelss and adhesives with the following fire-test-response characteristics as determined by testing identical products applied with identical adhesives to substrates per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Surface-Burning Characteristics: As follows, Class III per ASTM E 84:
      a. Flame-Spread Index: 200 or less.
      b. Smoke-Developed Index: 450 or less

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials clearly labeled to identify Manufacturer, brand name, quality or grade and fire hazard classification.

B. Store horizontally in original undamaged packages.

C. Remove foreign matter from face of panel with soft bristle brush, avoiding abrasive action.

1.8 PROJECT/SITE CONDITIONS

A. Environmental Requirements: Install materials when temperature and humidity conditions approximate conditions that will exist when building is occupied.

B. Provide ventilation to disperse fumes during application of adhesive as recommended by adhesive manufacturer.

1.9 EXTRA MATERIALS

A. Supply two extra sheets of FRP of each type used in clean, marked for Owner's use. Material must be in manufactures package, unopened.

B. Supply 10% of each type of moldings. Moldings must be packaged in a round tube to be sealed on both ends to protect the moldings from damages. Container must identify the quantity and type of each piece.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products.
   1. Marlite FRP with Sani-Coat Sealer, Marlite, Dover, OH
   2. Glasbord-P with Surfaseal, Kemlite Corporation
   3. LascoBoard Sta-Clean Class III, Lasco Panel Products, Florence, KY

2.2 MATERIALS

A. Panels and Accessories: Provide the following:
   1. Fiberglass reinforced plastic, 0.09 inches thick, minimum. Product shall meet or exceed the following:

Property	ASTM Test Method	Units
Bearing Strength	D 953	psi 20,000
Flexural Strength	D 790	psi 1.7×10^4
Flexural Modulus	D 790	psi 6.0×10^6
Tensile Strength	D 638	psi 8.0×10^3
Coefficient of Lineal Thermal Expansion	D 696	in/in F 1.57×10^{-5}
Water Absorption	D 570	% < 0.5
Thermal Conductivity (K-factor)	C 177	BTU/in/1.2 hr/ft^2/ F
Flame Spread	E 84	- <200
Smoke Developed	E 84	- <450

   2. Color/Texture: White panel with smooth finish.

B. Adhesive: Manufacturer's recommended type for use with selected materials, waterproof, mildew resistant nonstaining type.

C. Sealant: Latex type as approved by adhesive and wall paneling manufacturer.

D. Moldings: If not specifically noted elsewhere, use extruded aluminum molding trim pieces. Use at panel divisions, internal and external corners, including end cap molding.

E. Miscellaneous Items: Furnish and install supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation, whether or not specified or indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Examine substrate and conditions under which the material is to be installed.

2. Verify that surfaces, when tested with moisture meter, have proper moisture content.
3. Verify that nails and screws are recessed, with joints and depressions taped, finish and sealed.
4. Remove contaminants from areas to be covered.
5. Do not proceed with Work until work of other trades which passes through wall covering has been completed and unsatisfactory conditions have been corrected.
6. Start of Work indicates acceptance of responsibility for performance and any required remedial Work.

3.2 INSTALLATION

A. Install panels in accordance with manufacturer's printed instructions using full sheet mastic coverage method with no exposed fasteners or "buttons."

B. Make joints with 1/8 inch space for expansion and use moldings designed for each condition for the Project.

C. Bevel edges of panels with block plane to permit proper fit into moldings.

D. If one end of panel must be nailed, do not nail the other end.

E. Remove plumbing escutcheons, switchplates, wall plates, and surface-mounted fixtures, and cut wall paneling evenly to fit. Replace items after completion of Work.

F. Where applicable, install paneling before installation of plumbing, casings, bases, cabinets and other items to be applied over paneling.

3.3 CLEANING

A. Remove excess adhesive and smudges with soft cloth and mineral spirits, or with product recommended by wall panel manufacturer.

- END OF SECTION -

- SECTION 06 6500 -

SOLID POLYMER FABRICATIONS

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. Work described in this section includes counter tops.

1.3 RELATED WORK

A. Section 06 4023 “Interior Architectural Woodwork” for millwork.

B. Section 07 9200 “Joint Sealants” for caulking perimeter of solid surfacing units to adjacent surfaces to produce a water tight attachment.

1.4 REFERENCES

A. Applicable Standards: Standards of the following, as referenced herein:
   1. American National Standards Institute (ANSI)

B. American Society for Testing and Materials (ASTM)
   1. National Electrical Manufacturers Association (NEMA)
   2. Federal Specifications (FS)

1.5 SUBMITTALS

A. Shop drawings: Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.

B. Samples: Submit minimum 2" x 2" (50 mm x 50 mm) samples. Indicate full range of color and pattern variation. Approved samples will be retained as standards for work.

C. Product data: Indicate product description, fabrication information and compliance with specified performance requirements.

D. Maintenance data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in project close-out documents.

1.6 QUALITY ASSURANCE

A. Allowable tolerances:
1. Variation in component size: ± 1/8" (3 mm).
2. Location of openings: ± 1/8" (3 mm) from indicated location.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver no components to project site until areas are ready for installation. Store components indoors prior to installation.

B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.8 WARRANTY

A. Provide manufacturer's 10 year warranty against defects in materials. Warranty shall provide material and labor to repair or replace defective materials. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

PART 2 - PRODUCTS

2.1 MANUFACTURES

A. Basis for Design: Corian Surface manufactured by E. I. du Pont de Nemours and Company, Wilmington DE (800) 426-7486 Website: www.corian.com

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Avonite, Inc.
2. E. I. du Pont de Nemours and Company, Corian Surfaces.
3. Meganite Inc.; a division of the Pyrochem Group.
4. Technistone USA, Inc..

2.2 SOLID-SURFACING-MATERIAL COUNTERTOPS

A. Grade: Premium.

B. Solid-Surfacing-Material Thickness: 3/4 inch (19 mm).

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
1. As selected by Architect from manufacturer's full range.

D. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

1. Fabricate tops with shop-applied edges of materials and configuration indicated.
2. Fabricate tops with shop-applied backsplashes.

E. Drill holes in countertops for plumbing fittings and in shop.

2.3 SOLID POLYMER MATERIALS

A. Solid-Surfacing Material: Homogeneous solid sheets of filled acrylic resin complying with ISSFA-2, meeting ANSI Z124.3 & .6, Type Six, and Fed. Spec. WW-P-541E/GEN.

1. Superficial damage to a depth of 0.010" (.25 mm) shall be repairable by sanding and polishing.

B. Lavatory tops with seamed bowls; 3/4" (19 mm) thick countertop of solid polymer material, having edge details as indicated on the interior finish drawings. Provide countertops complete with backsplashes of size shown on the interior finish drawings.

C. Performance characteristics:

	PROPERTY /TYPICAL RESULT	TEST
1.	Tensile Strength /6,000 psi	ASTM D 638
2.	Tensile Modulus / 1.5 x 106 psi	ASTM D 638
3.	Tensile Elongation / 0.4% min.	ASTM D 638
4.	Flexural Strength 10,000 psi	ASTM D 790
5.	Flexural Modulus 1.2 x 106 psi	ASTM D 790
6.	Hardness >85 Rockwell “M” Scale	ASTM D 785
7.	56 Barcol Impressor	ASTM D 2583
8.	Thermal Expansion 3.02 x 10-5 in./in./°C (1.80 x 10-5 in./in./°F)	ASTM D 696
9.	Gloss (60° Gardner) 5–75 (matte—highly polished)	ANSI Z124
10.	Light Resistance (Xenon Arc) No effect	NEMA LD 3-2000 Method 3.3
11.	Wear and Cleanability Passes	ANSI Z124.3 & Z124.6
12.	Stain Resistance: Sheets Passes	ANSI Z124.3 & Z124.6
13.	Fungus and Bacteria Resistance Does not support microbial growth	ASTM G 21 & G 22
14.	Boiling Water No visible change	NEMA LD 3-2000 Resistance Method 3.5
15.	High Temperature No change	NEMA LD 3-2000 Resistance Method 3.6
16.	Izod Impact 0.28 ft.-lbs./in. of notch (Notched Specimen) (Method A)	ASTM D 256

17. Ball Impact No fracture—1⁄2 lb. ball: NEMA LD 3-2000
    Resistance: Sheets 1⁄4" slab—36" drop Method 3.8
    1⁄2"† slab—144" drop
18. Weatherability E*94<5 in 1,000 hrs. ASTM G 155
19. Specific Gravity† 1.7
20. Water Absorption Long-term ASTM D 570
    0.4% (3⁄4")
    0.6% (1⁄2"†)
    0.8% (1⁄4")
21. Toxicity 99 (solid colors) Pittsburgh Protocol
22. 66 (patterned colors) Test (“LC50” Test)
23. Flammability All colors ASTM E 84,
24. (Class I and Class A) NFPA 255 & UL 723
    Flame Spread Index <25
    Smoke Developed Index <25
25. TECHNICAL BULLETIN C-1-2004
26. †Approximate weight per square foot 1⁄4" (6 mm) 2.2 lbs. • 1⁄2"† (12.3 mm) 4.4 lbs.
27. Shapes meet or exceed the ANSI Z124.3 and ANSI Z124.6 standards for plastic sinks and lavatories.
28. NEMA results based on the NEMA LD 3-2000

2.4 ACCESSORY PRODUCTS

A. Joint adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints, with a chemical bond.

2.5 FABRICATION

A. For warranty coverage, fabricator/installer shall be approved by solid polymer manufacturer.

B. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and solid polymer manufacturer requirements.

C. Form joints between components using manufacturer's standard joint adhesive. Joints shall be inconspicuous in appearance and without voids. Attach 2" (50 mm) wide reinforcing strip of solid polymer material under each joint.

D. Provide holes and cutouts for plumbing and bath accessories as indicated on the drawings.

E. Rout and finish component edges to a smooth, uniform finish. Rout all cutouts, and then sand all edges smooth. Repair or reject defective or inaccurate work.

F. Finish: All surfaces shall have uniform finish.
   1. Matte ,with a gloss rating of 5 - 20

PART 3 - EXECUTION

3.1 JOB MOCK-UP

A. Prior to final approval of shop drawings, erect one full size mock-up of each component at project site for Owner's Representative review.

B. Should mock-up not be approved, rework or remake until approval is secured. Remove rejected units from project site.

C. Approved mock-ups shall remain as part of finished work.

3.2 INSTALLATION

A. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
3. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

B. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.

C. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Components shall be clean on Date of Substantial Completion.

D. Make plumbing connections to sinks in accordance with Division 15. Mechanical.

3.3 REPAIR & PROTECTION

A. Protect surfaces from damage until Date of Substantial Completion. Repair or replace damaged work that cannot be repaired to Owner's Representative's satisfaction.

B. Fabricator/Installer is to provide a commercial care and maintenance video, review maintenance procedures and warranty details with the director of maintenance upon completion of project.

- END OF SECTION -

DIVISION 07 – THERMAL & MOISTURE PROTECTION

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- SECTION 07 1326 -

SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Modified bituminous sheet waterproofing, fabric reinforced.
   2. Protection Board.

1.3 RELATED SECTIONS

A. Section 07 9200 "Joint Sealants" for joint-sealant materials and installation.

1.4 SUBMITTALS

A. General: Submit in accordance with Section 01 3219.

B. Product Data: Submit product data for materials and accessories.

C. Submit following Informational Submittals:
   1. Certifications specified in Quality Assurance article.
   2. Qualification Data: Applicator's qualification data.
   3. Manufacturer's instructions; include applicable temperature ranges.
   4. Manufacturer’s Field Reports: Written results and findings of manufacturer’s field services specified as part of Field Quality Control.

D. Closeout Submittals:
   1. Submit under provisions of Division 01.
   2. Warranty: Submit specified warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Not less than 5 years documented experience in manufacturing of specified waterproofing.
   2. Obtain primary waterproofing materials from single manufacturer. Manufacturer's name shall appear on containers.
   3. Provide secondary materials as required by manufacturer of primary materials.
   4. Manufacturer's qualified technical representative will be required to visit Project site to advise applicator of procedures and precautions for installation of waterproofing materials.
   5. Manufacturer's technical representative will be required to be at Project site weekly during installation and immediately prior to installation of protection board to ensure waterproofing has been properly installed and warranty requirements have been met.

B. Applicator Qualifications:
   1. Acceptable to membrane manufacturer prior to execution of this Contract.
   2. Company specializing in application of specified waterproofing.
   3. Minimum 3 years documented experience with submitted product.

C. Owner reserves right to hire independent waterproofing consultant to review submittals, procedures, and installation.

D. Certifications:
   1. Submit manufacturer's certification stating materials ordered and supplied are compatible with each other, suited for locale and purpose intended and shipped in sufficient quantity to ensure proper timely installation.
   2. Certification shall also state that waterproofing materials have express warranty of fitness for the particular purposes of this Project.
   3. Certify materials shipped to Project site meet membrane manufacturer's published performance standards and requirements of this Specification.

1.6 PRE-INSTALLATION CONFERENCE

A. Conduct pre-installation conference in accordance with Division 01.

B. Agenda:
   1. Review Project Specifications and Drawings.
   2. Establish installation schedules and sequence.
   3. Coordinate work with in-place and subsequent construction.
   4. Review weather and working conditions.
   5. Review installation procedures, including:
      a. Substrate requirements for Project acceptance (curing of concrete surface, form release agents, temperature).
      b. Waterproofing installation.
      c. Phasing and sequencing requirements.

d. Termination, flashing, expansion joint, and penetration requirements.
e. Review inspection, testing, and quality control procedures.
f. Review protection requirements for construction period beyond waterproofing installation.

C. Conduct tour of areas to be waterproofed and report on surface acceptance, possible problem areas, and recommended remedies.

1.7 DELIVERY, STORAGE AND HANDLING

A. Comply with requirements of Section 01 6000.

B. Do not double stack membrane pallets.

C. Keep primer, mastics and adhesives in dry area away from flames, sparks and excessive heat.

D. Store material in dry area out of direct sunlight.

E. Cover materials and allow for adequate ventilation.

1.8 PROJECT CONDITIONS

A. Environmental Requirements:
1. Do not apply products when surface or ambient temperature is below 40 degrees F unless special low temperature products are used.
2. Do not apply products in any instances where surface temperature is lower than 25 degrees F.
3. Do not apply to damp or frozen surfaces or during inclement weather.

B. Do not work or walk on exposed waterproofing membrane. Install permanent protection board immediately to protect membrane during subsequent work operations.

1.9 SEQUENCING

A. Coordinate and sequence work to ensure that construction materials placed against or over waterproofing and protection system will occur within 7 days of membrane installation. Do not expose membrane to ultraviolet rays beyond period of time recommended by system manufacturer.

B. Install protection board within 24 hours of membrane installation.

1.10 WARRANTY

A. Comply with requirements of Section 01 7700.

B. Provide custom warranty or standard warranty with attachments for full replacement value of completed installation signed by manufacturer, applicator and Contractor warranting against water infiltration and defects of materials and workmanship for period of 5 years from date of Substantial Completion. If manufacturer will not allow installer and Contractor to sign manufacturer's warranty, append installer and Contractor's warranty to manufacturer's warranty to create warranty that covers labor and workmanship, including labor for access to waterproofing, for watertight warranty.

C. Warrant penetrations, terminations, sealants, expansion joints, membrane, and protection board.

D. Warranty shall include removing and reinstalling superimposed work covering waterproofing.

E. Warranty with disclaimer disallowing implied warranties of merchantability and/or fitness for a particular purpose or other disclaimers that reduce Owner protection is not acceptable. If manufacturer's standard warranty is used and the warranty disclaims implied or expressed warranties of merchantability and fitness, the manufacturer shall remove that disclaimer and have authorized representative initial noting acceptance of warranty responsibility.

PART 2 - PRODUCTS

2.1 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Modified Bituminous Sheet: 60-mil- (1.5-mm-) thick, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated to a 4-mil- (0.10-mm-) thick, polyethylene film with release liner on adhesive side and formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Bituthene 4000 Waterproofing System, Grace Construction Products, Cambridge, MA.
   b. MEL-ROL or MEL-GARD, W. R. Meadows, Inc., Elgin, IL.
   c. Miradri 860, MiraDRI Moisture Protection, Norcross, GA.
   d. Polyguard No. 650 Membrane, Polyguard Products, Inc., Ennis, TX.
2. Sheet Membrane: Self-adhering membrane of rubberized asphalt laminated to polyethylene sheet or heavy-duty protection course.
   a. Low temperature grade when dictated by temperature at time of application.
   b. Compatible with water based primer.
   c. Physical Properties:
      1) Tensile Strength: 250 psi (1.7 MPa) minimum; ASTM D 412, Die C, modified.
      2) Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
      3) Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D 1970.
      4) Crack Cycling: Unaffected after 100 cycles of 1/8-inch (3-mm) movement; ASTM C 836.

5) Puncture Resistance: 40 lbf (180 N) minimum; ASTM E 154.
6) Hydrostatic-Head Resistance: 150 feet (45 m) minimum; ASTM D 5385.
7) Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D 570.
8) Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m); ASTM E 96, Water Method.

B. Primer/Conditioner: Water-based VOC compliant type required by membrane manufacturer. No solvent or 1,1,1 - Trichloroethane based primers will be accepted.

C. Mastic: Rubberized asphaltic type required by membrane manufacturer.

D. Liquid Membrane: Two component elastomeric, mastic grade as furnished by membrane manufacturer.

E. Cement Mortar: Epoxy or latex modified cementitious composition acceptable to membrane manufacturer.

F. Concrete Patching Compound: Fast setting, non-shrinking patching compound, of type acceptable to membrane manufacturer.

G. Fan-Fold Protection Board (Vertical Applications):
1. Type: Extruded polystyrene sandwiched between non-perforated film laminates designed for use in commercial foundation waterproofing applications; 15 psi compressive strength.
2. Thickness: 1/4 inch.
3. Acceptable Product:
a. AMOCOR-PB4 Protection Board, Tenneco Building Products Company, Smyrna, GA.
b. Dow Protection Board II, The Dow Chemical Company, Midland, MI.
c. UCI Underlayment Board, Owens Corning Foamular, Parsippany, NJ.

H. Protection Board Adhesive: Type required by board manufacturer and compatible with membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and proceed with work when substrates are ready.

B. Ensure surfaces are reasonably smooth and free of holes, cracks or projections which might be detrimental to successful installation.

C. Verify that curing methods used for concrete are compatible with membrane system.

D. Verify that horizontal surfaces have smooth wood float finish, free from defects. Broom finish not acceptable.

E. Verify that items penetrating waterproofing system are securely installed.

F. Verify that concrete surfaces have cured a period of time acceptable to membrane manufacturer.

G. Verify that masonry joints are struck flush with face of unit.

3.2 PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Clean and prepare surfaces in accordance with manufacturer's instructions.

C. Seal cracks and joints in accordance with manufacturer's instructions. Use proper depth-width ratio required by sealant manufacturer.

D. Remove sharp projections, fins, and loose material. Remove form ties to 3/4 inch minimum behind face of wall. Fill holes, voids, and honeycomb areas flush with concrete patching compound or cement mortar.

E. Seal penetrations with mastic.

F. Provide fillet or cant at junction of vertical and horizontal surfaces using cast-in-place cement mortar in configuration acceptable to membrane manufacturer.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings.

B. Apply primer/conditioner at rate required by manufacturer. Install only as much primer/conditioner as can be covered in same day.

C. Prior to placing full membrane, provide membrane strips at inside corners, outside corners, and working joints. Center strips along axis of corner and joint.

D. Extend membrane over footing and down face 6 inches minimum, except terminate at point 12 inches below floor slab of protected space where footings are at greater depth.

E. Install membrane in shingle fashion with edges and ends overlapped at dimensions required by manufacturer.

F. Remove release paper layer. Roll out laps and surface with mechanical roller to encourage full contact bond.

G. Completely bond membrane to substrate, except those areas directly over or within 3 inches of working cracks or expansion joints.

H. Place uniform bead of mastic to joint edges at locations required by manufacturer.

I. Seal perimeter ends and edges to adjoining surfaces.

J. Seal items penetrating membrane with flashing membrane material and liquid membrane. Ensuring positive seal with membrane and penetrating member.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:
   1. Comply with requirements of Section 01 4200.
   2. Notify manufacturer prior to start of Work and make arrangements for manufacturer's technical representative to be present during first day's work to verify work is being conducted in accordance with their requirements.
   3. Submit summary report; include Project site observations, instructions and monitoring activities.

B. Flood Tests - Horizontal Surfaces:
   1. Before completed surfaces are covered by other work, test for leaks with 2 inch depth of water maintained for 48 hours.
   2. Repair leaks revealed by examination of substructure, and repeat test until no leakage is observed.

3.5 PROTECTION AND CLEANING

A. Protect finished work in accordance with Section 01 7400.

B. Protect adjacent surfaces from damages and stains. Clean materials from surfaces where inadvertently applied.

- END OF SECTION -

- SECTION 07 2100 -

THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Cavity-wall insulation.
   2. Concealed building insulation.
   3. Exposed building insulation.
   4. Fire safing insulation.
   5. Expanding foam insulation.
   6. Vapor retarders.

1.3 RELATED SECTIONS

A. Section 01 8113 "Sustainable Design (LEED) Requirements" for additional LEED requirements.

B. Section 07 5400 “Thermoplastic Membrane (TPO) Roofing“ for insulation specified as part of single ply membrane roofing construction.

C. Section 07 8413 “Penetration Firestopping” for sealing penetrations through fire rated assemblies.

D. Section 07 8446 "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire-resistive joint system.

E. Section 09 8100 “Acoustical Insulation” for sound attenuation blankets within interior partitions.

F. Division 23 Section "Mechanical Insulation."

1.4 REFERENCES

A. ASTM C165 - Test Method for Measuring Compressive Properties of Thermal Insulations.

B. ASTM C411 - Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2001.

D. ASTM C764 - Specification for Mineral Fiber Loose-Fill Thermal Insulation.

E. ASTM C1104 - Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation.

F. STM C1304 - Standard Test Method for Assessing the Odor Emission of Thermal Insulation Materials.

G. ASTM C1320 - Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation.

H. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2001.

J. ASTM E96 - Test Methods for Water Vapor Transmission of Materials.

K. ASTM E119, - Test Methods for Fire Tests of Building Construction and Materials.

1.5 DEFINITIONS

A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.6 PERFORMANCE REQUIREMENTS

A. Plenum Rating: Provide glass-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.

1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm (13-m/s) air velocity.
2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosium on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

1.7 SUBMITTALS

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

B. Samples for Verification: Full-size units for each type of exposed insulation indicated.

C. LEED Submittal:
1. Product Data for Credit MR 4.1 and MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
   a. Include statement indicating costs for each product having recycled content.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.

E. Research/Evaluation Reports: For foam-plastic insulation.

1.8 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
1. Surface-Burning Characteristics: ASTM E 84.
2. Fire-Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic insulation as follows:
1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 FORMALDEHYDE-FREE INSULATING MATERIALS

A. Manufacturers:
   1. CertainTeed Corporation.
   2. Dow Chemical
   3. Guardian Fiberglass, Inc.
   4. Johns Manville.
   5. Knauf Fiber Glass.
   6. Owens Corning.

B. Green Guard Certified or formaldehyde-free Unfaced Glass-Fiber Batt Insulation: Unfaced Batts; ASTM C665, Type I (blankets without membrane facing); with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; and of the following properties:
   1. Combustion Characteristics: Passes ASTM E136.
   2. Critical Radiant Flux: ASTM E970, greater than 0.11 Btu/sq ft s (0.12 W/cm sq).
   3. Water Vapor Sorption: ASTM C1104, 5 percent or less.
   4. Odor Emission: Passes ASTM C1304.
   5. Corrosiveness: Passes ASTM C665.
   6. Fungi Resistance: Passes ASTM C1338.
   7. Recycled Content: Certified by Scientific Certification Systems to contain minimum of 18 percent post-consumer and seven (7) percent pre-consumer recycled glass product, on average of manufacturer's products.

C. Green Guard Certified or formaldehyde-free FSK-25 Faced Glass-Fiber Batt Insulation: JM Formaldehyde-Free FSK-25 Faced Batts; ASTM C665, Type III, Class A, Category 1 with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; and of the following properties:
   1. Combustion Characteristics: Passes ASTM E136.
   2. Critical Radiant Flux: ASTM E970, greater than 0.11 Btu/sq ft s (0.12 W/cm sq).
   3. Water Vapor Permeance: ASTM E96, 0.05 Perms (3 ng/Pa-s m2).
   4. Water Vapor Sorption: ASTM C1104, 5 percent or less.
   5. Odor Emission: Passes ASTM C1304.
   6. Corrosiveness: Passes ASTM C665, 13.8.
   7. Fungi Resistance: Passes ASTM C1338.
   8. Recycled Content: Certified by Scientific Certification Systems to contain minimum of 18 percent post-consumer and seven (7) percent pre-consumer recycled glass product, on average of manufacturer's products

2.3 GLASS-FIBER BLANKET INSULATION

A. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:

1. 3-1/2 inches (89 mm) thick with a thermal resistance of 11 deg F x h x sq. ft./Btu at 75 deg F (1.9 K x sq. m/W at 24 deg C).
2. 3-5/8 inches (92 mm) thick with a thermal resistance of 11 deg F x h x sq. ft./Btu at 75 deg F (1.9 K x sq. m/W at 24 deg C).
3. 5-1/2 inches (140 mm) thick with a thermal resistance of 21 deg F x h x sq. ft./Btu at 75 deg F (3.7 K x sq. m/W at 24 deg C).
4. 6-1/2 inches (165 mm) thick with a thermal resistance of 19 deg F x h x sq. ft./Btu at 75 deg F (3.3 K x sq. m/W at 24 deg C).

2.4 VAPOR RETARDER

A. Polyethylene Vapor Retarder: ASTM D 4397, 6 mils (0.15 mm) thick, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).

B. Reinforced-Polyethylene Vapor Retarder: 2 outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 25 lb/1000 sq. ft. (12 kg/100 sq. m), with maximum permeance rating of 0.0507 perm (2.9 ng/Pa x s x sq. m).

1. Available Products:
   a. Raven Industries Inc.; DURA-SKRIM 6WW.
   b. Reef Industries, Inc.; Griffolyn T-65.

C. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

D. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

E. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.

2.5 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths, and lengths.

B. Unfaced Mineral-Fiber Blanket Insulation: Thermal insulation combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665, Type I (blankets without membrane facing).

1. Mineral Fiber Type: Fibers manufactured from glass.
2. Surface Burning Characteristics: Maximum flame-spread and smoke-developed index of 20.

C. Faced Mineral Fiber Blanket/Batt Insulation: Thermal insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type III, Class A (blankets with reflective vapor-retarder membrane facing with flame spread of 25 or less); foil-scrim-Kraft (FSK) membrane on one face, and as follows:

1. Mineral Fiber Type: Fibers manufactured from glass.
2. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 25 and 50, respectively.

D. Unfaced, Glass-Fiber Board Insulation: Thermal insulation combining glass fibers with thermosetting resin binders to comply with ASTM C 612, Type IA and IB; and with other requirements indicated below:

1. Nominal density of 3 lb/cu. ft., thermal resistivity of 4.3 deg F x h x Sq. Ft./Btu x in. at 75 deg F.
2. Thickness: 2 inches unless shown otherwise (R-8.7).

2.6 EXPANDING FOAM INSULATION

A. Liquid type foam or light weight concrete with a minimum wet density of 2.0 pounds per cubic foot and a minimum R-value of 3.9 per 1-inch thickness.

B. Acceptable products are as follows:

1. "Tripolymer" system as manufactured by C.P. Chemical Co., Inc. (914/428-2517).
2. "Air Krete" as manufactured by Nordic Builders (480/892-0603).
3. "Core-Fill 500" as manufactured by Tailored Chemical Products, Inc. (704/322-6512).
4. "PolyMaster R-501" as manufactured by PolyMaster, Inc. (800/580-3626).

2.7 SAFING INSULATION AND ACCESSORIES

A. Safing insulation shall be USG Thermafiber mineral fiber safing insulation, unfaced. Insulation shall comply with ASTM C665, Type I; ASTM C612, Classes 1 and 2; and have nominal 4.0 pcf density.

B. Sealant shall be as approved by manufacturer of safing insulation for conditions shown.

2.8 AUXILIARY INSULATING MATERIALS

A. Wire and Insulation Supports: As manufactured by E-Z Wire Products or as recommended by insulation manufacturer.

B. Adhesively Attached Pin Anchors: Perforated plate, 2 inches square, welded to projecting pin, with self-locking washer, complying with the following requirements:

1. Plate: Zinc-plated steel, 0.106 inch thick.
2. Pin: Copper-coated low carbon steel, fully annealed, 0.106 inches in diameter, length to suit depth of insulation indicated and, with washer in place, to hold insulation tightly to substrate behind insulation.
3. Self-Locking Washer: Mild steel, 0.016 inch thick, size as required to hold insulation securely.

a. Where spindles will be exposed to human contact after installation, protect ends with capped self-locking washers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions with Installer present, for compliance with requirements of the Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor retarders, including removal of projections that might puncture vapor retarders.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's instructions applicable to products and application indicated. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with installation of insulation.

B. Extend insulation full thickness as indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement.

C. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrate by method indicated, complying with manufacturer's written recommendations. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units. Place insulation at exterior wall construction, and where shown on Drawings in manner to insure continuous thermal barrier.

B. Install unfaced batts in wall framing where shown. Friction fit.

1. Install batts above termination of gypsum wallboard utilizing 18 gauge wire perpendicular to the batt at 18 inches on center, or attach pin anchor at intervals required by insulation manufacturer.

C. Set reflective, foil-faced units accurately with not less than 0.75-inch air space in front of foil. Set foil face to warm side of construction unless shown otherwise.

1. Insulation in attic at plenum spaces, which are exposed to view, shall be Type III foil-scrim-Kraft faced.

3.5 INSTALLATION OF VAPOR RETARDER

A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Before installing vapor retarder, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarder with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.

C. Firmly attach vapor retarder to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarder with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.

E. Repair tears or punctures in vapor retarder immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.6 INSTALLATION OF SAFING INSULATION

A. Install safing insulation to fill gap between top of partition and horizontal material above, or as otherwise shown on Drawings. Apply sealant to complete safing assembly, as shown in Gypsum Association Fire Resistance Design Manual (15th Edition), Section II (Requirements for Fire Protection).

3.7 INSTALLATION, FOAM INSULATION

A. Install in accordance with manufacturer’s printed instructions to assure complete filling of cores. Fill penetrations through concrete foundation and exterior concrete walls.

3.8 PROTECTION

A. General: Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

3.9 SCHEDULE

A. Faced batt insulation at all exterior walls, (R-13) as detailed.

B. Unfaced batt insulation (R-13) at exterior framed or suspended soffits.

C. Unfaced batt insulation (R-11) between conditioned and non-conditioned interior spaces.

D. Expanding foam insulation at penetration through exterior concrete walls.

3.10 PROTECTION AND CLEANING

A. Protect adjacent surfaces, landscaping and property from spillage, overspray, or drift.

B. Clean spillage, overspray, or drift from adjacent surfaces; remove immediately in accordance with manufacturer's instructions.

- END OF SECTION -

- SECTION 07 2600 -

UNDER-SLAB VAPOR BARRIER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Under slab vapor barrier membranes
   2. Seam tape and mastic.
   3. Pipe boots
   4. Course and fine granular fill.

1.3 RELATED SECTIONS

A. Section 02 3100 “Subsurface Investigation” and Appendix ‘A’ for Geotechnical Report and installation recommendations.

B. Section 03 3000 “Cast-in-Place Concrete” for coordination of vapor barrier installation during base preparation for slab on grade installations.

1.4 DEFINITIONS

A. Perm: 1 grain/h•ft^2•in-Hg.

1.5 SUBMITTALS

A. General: Submit following items in accordance with Section 01 3219.

B. Product Data: Submit product data for each product, including penetration accessories and tape.

1.6 SEQUENCING

A. Begin installation only after substrate work is complete and penetrations are securely anchored.

B. Coordinate with work as specified in Section 03 3000 “Cast-in-Place Concrete”.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: The design based on Stego Wrap 15Mil Vapor Barrier by Stego Industries LLC. San Juan Capistrano, CA. tel (877) 464-7834 or 949.493.5460, www.stegoindustries.com.

1. Subject to compliance with requirements, provide the named product or a comparable product by one of the following manufactures:
   a. Stego Wrap 15Mil Vapor Barrier; Stego Industries LLC.
   b. Premounded Membrane with Plasmatic Core; W.R. Meadows.
   c. Zero-Perm; Alumiseal

2.2 MATERIALS

A. Vapor Barrier: Minimum 15-mil thick polyolefin geotextile membrane, manufactured with prime, virgin resins with the following properties.

Water Vapor Barrier	Class A (Plastics)	ASTM E1745
Water Vapor Transmission Rate:	> 0.006 gr./ft^2 /hr.	ASTM E 96
Permeance Rating	≥ 0.01 perms	ASTM E 96
Puncture Resistance	2200 grams, min	ASTM D 1709
Minimum Tensile Strength	50.0 lbf./in	ASTM D 882

B. Joint Tape: Manufacturer’s recommended, pressure sensitive type, self adhering, and of perm rating not less than vapor retarder.

1. Minimum 15-mils thick by minimum 4 inches wide
2. Water Vapor Transmission Rate; 0.01 perms or lower, ASTM E 96.

C. Adhesive: Type recommended by manufacturer of sheet products, non-sagging grade, compatible with sheet and substrate. Water Vapor Transmission Rate shall be 0.3 perms or lower per ASTM E 96.

D. Pipe Boots: Construct pipe boots from vapor barrier material, pressure sensitive tape, and mastic per manufactures instructions.

E. Vapor Proofing Mastic: Type recommended by manufacturer, non-sagging grade, compatible with sheet and substrate. Water Vapor Transmission Rate shall be 0.01 perms or lower per ASTM E 96.

F. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

G. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch (9.5-mm) sieve, 10 to 30 percent passing a No. 100 (0.15-mm) sieve, and at least 5 percent passing No. 200 (0.075-mm) sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and proceed with Work when substrates are ready.

B. Verify that substrate work is complete, clean, dry and installed in accordance with contract documents before beginning installation of sheet products.

C. Level and tamp or roll aggregate, sand or tamped earth base

3.2 INSTALLATION

A. Under Slab-on-Grade: Installation shall be in accordance with manufacturer's instructions and ASTM E 1643-98.

1. Unroll Vapor Barrier with the longest dimension parallel with the direction of the pour.
2. No penetration of the Vapor Barrier is allowed except for reinforcing steel and permanent utilities.
    a. Seal all penetrations (including pipes) with pre-manufactured boots per manufacturer's instructions.
3. Lay-out sheets to minimize quantity of joints. Lap edge 6 inches minimum and end joints 12 inches minimum and continuously seal with joint tape.
4. Terminate barrier per manufactures recommendations along perimeter; at footers, vertical walls, and against penetrations. Seal perimeter with continuous mastic bead along foundation walls. Seal barrier joints with tape.
5. Refer to Section 03 3000 "Cast-in-Place Concrete" for installation coordination requirements.
6. Repair damaged areas by cutting patches of Vapor Barrier/Retarder, overlapping damaged area 6 inches and taping all four sides with tape.

3.3 PROTECTION

A. Protect sheets from puncture during installation. Patch punctures before proceeding with subsequent construction.
    a. NOTE: SCREEDING STAKES DRIVEN THROUGH BARRIER must be repaired per manufactures recommendation.

B. Install runway planks in construction traffic lanes until slabs are poured.

3.4 FIELD QUALITY CONTROL

A. Conduct a visual inspection, in the presence of the Architect/Engineer, of the entire barrier installation the day before pouring concrete. Make all corrections prior to pouring any concrete.

3.5 SCHEDULE

A. Install beneath slab-on-grade throughout the building.

- END OF SECTION -

- SECTION 07 2700 -

PERMEABLE VAPOR BARRIER (RAIN SCREEN)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes permeable air and vapor barriers.

1.3 RELATED SECTIONS

A. Section 06 1600 “Sheathing” for exterior sheathing.

B. Section 07 4215 “Glass Façade Panel System” for glass façade panels.

C. Section 07 4219 “Metal Plate Wall Panels” for metal wall panels.

D. Section 07 6200 "Sheet Metal Flashing and Trim" for sheet metal flashings.

E. Section 07 9200 "Joint Sealants" for joint-sealant materials and installation.

1.4 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air Barrier Assembly Air Leakage: Not to exceed 0.03 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.15 L/s x sq. m of surface area at 75 Pa); ASTM E 283.

1.5 REFERENCES

A. AATCC Test Method 127 - Water Resistance: Hydrostatic Pressure Test; 1998.

B. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

C. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials; Compliant with Procedure B (Water Method) for interior to exterior testing.

1.6 SUBMITTALS

A. Product Data: Include manufacturer's written instructions, technical data, and tested physical and performance properties of breathable underlayment.
   1. Framing or blocking members.
   2. Girts.
   3. Thermal Insulation.
   4. Sheathing.
   5. All exterior cladding and corner conditions.
   6. Door or window frames.
      a. Sill pans.
   7. Through-Wall Metal Flashing.
   8. Balcony and railing penetrations.
   9. Structural Tieback Penetrations.
   10. Pipe, Conduit and Duct penetrations.
      a. Include actual manufactured “weather-heads.”

B. Samples:
   1. 8-1/2-x-11-inch square of breathable underlayment sheet.
   2. Tapes (Single & Double-Sided).
   3. Factory fabricated window-opening corners.
   4. Provide materials and fasteners for mock-up.

C. Manufacturer’s Instructions: Provide manufacturer’s instructions showing the recommended procedures and sequence of installation of breathable underlayment in Rainscreen installations.

1.7 QUALITY ASSURANCE

A. Underlayment manufacturer shall have an on-going quality control program with inspections by a nationally recognized independent organization and shall be so labeled.

B. Source Limitations: Obtain all breathable underlayment through one source from a single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review requirements for underlayment, including surface preparation specified under other Sections, substrate condition and pretreatment, temporary weather protection, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original containers with seals unbroken, wrapped in a polythene sleeve, labeled with manufacturer's name, and product brand name.

B. Store rolls under cover, on a clean, level surface, either flat or upright.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Product: The design is based on WallShield manufactured by VaproShield™ L.L.C., distributed by W.H. Steele Co., phone (626) 303-3831. www.VaproShield.com

B. Products: Subject to compliance with requirements, provide the named product or a comparable product by one the following manufacturers:

1. SPR Canada Inc., 191 Booth Road, Unit #1, North Bay, ON, P1A 4K3, phone (866) 533-0233, 222. www.srpcanada.ca, Product: WallShield.

2.2 PHYSICAL PROPERTIES

A. Spun Bonded Polypropylene: Underlayment shall be furnished in standard rolls of 59” high (1-1/2 meters) and 164 feet (50 meters) long.

B. Thickness and Weight: 0.023 inches thick and 5.161 oz./ sq. yd.

C. Water Vapor Transmission: 212 perms per ASTM E 96-00, Method B (as tested by CNRC).

D. Water Penetration Resistance: 68 cm per ATTCC-127.

E. Color: Black.

F. Surface Burning Characteristics: ASTM E 84-

1. Flame Spread: Class A
2. Smoke Developed: Class A

2.3 AUXILIARY MATERIALS

A. Underlayment Flashing Rolls: VaproFlashing and VaproFlashing Factory Formed Corners for use in wrapping openings, distributed by VaproShield L.L.C.

1. Factory Formed Corners
   a. VaproFlashing Factory Formed Corners 18” x 18”, distributed by VaproShield L.L.C.
   b. SPR Pre-fab 18-inch by 18 inch, distributed by SPR Canada Inc.
2. Small Penetration Flashing
   a. As manufactured by Quick-Flash Inc., www.quickflashproducts.com

3. Open Joint Flashing
   a. 6" Black flashing with no lettering is to be installed behind any open vertical or horizontal joint to hide the black Wall Shield, and to increase the Ultra Violet protection through the Open Joint.

B. Tape
1. Single-Sided Tape:
   a. 3" VaproTape (Seam-Seal) for use to secure WallShield™ to itself and to substrates, distributed by VaproShield L.L.C. Manufactured by Eternabond. Color: Black.
   b. 4" VaproTape (Seam-Seal) for use to secure WallShield™ to itself and to substrates, distributed by SPR Canada Inc. Manufactured by Eternabond. Color: Black.
2. Double-Sided Sealing Tape
   a. 1" VaproTape (Double-Sided) for use to seal WallShield™ to itself and to substrates, distributed by VaproShield L.L.C. Manufactured by Eternabond.
   b. 1" VaproTape (Double-Sided) for use to seal WallShield™ to itself and to substrates, distributed by distributed by SPR Canada Inc. Manufactured by Eternabond.
   c. One-inch wide butyl rubber tape, subject to approval of the Architect.

C. Fasteners
1. Fasteners: Minimum No. 16 gage, 0.065-inch-leg-diameter (1.65 mm) stainless steel staples having minimum 7/16-inch (11.1 mm) crowns.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements and other conditions affecting performance.

3.2 SURFACE PREPARATION

A. Clean and prepare substrate according to manufacturer's written recommendations. Provide clean and dry substrate for breathable underlayment application.

3.3 PENETRATIONS

A. Pipes and Conduit: Install manufactured penetration sleeves sized for the penetration and installed as recommended by the manufacturer.

B. Windows:

1. Secure prefabricated Factory Formed Corners at windowsill ends. Next, lay strip of breathable underlayment across sill. Secure with tape or mechanical fasteners so that the underlayment used for the wall can be slipped underneath the corners and sill, allowing for a minimum lap of 4 inches.
2. Wrap a strip of breathable underlayment around jambs extending horizontally along walls a minimum of 9 inches.
3. Secure Factory Formed Corners at ends of window head. Next, lay strip of breathable underlayment across the opening, extending horizontally beyond the corners a minimum of 6 inches.
    a. Cut underlayment along the leading edge of the header an inch or two beyond each jamb, so that the nailing flange of the window may side up behind the underlayment.

C. Doors:

1. Wrap a strip of breathable underlayment around jambs, extending horizontally along walls a minimum of 9 inches.
    a. Secure Factory Formed Corners at ends of door head. Next, lay strip of breathable underlayment across the opening, extending horizontally beyond the corners a minimum of 6 inches.
    b. Cut underlayment along the leading edge of the header, an inch or two beyond each jamb, so that the nailing flange of the door may side up behind the underlayment.

D. Open Joints:

1. At all open joints wrap a redundant 6” high strip of black breathable underlayment with no lettering behind each open joint, to hide the black barrier, and to increase the UV protection through the open joint

3.4 BREATHABLE UNDERLAYMENT APPLICATION

A. Install membranes in accordance with manufacturer’s instructions over exterior sheathing. Secure the underlayment so that the subsurface is protected from weather until cladding can be installed.

1. First, wrap penetrations as specified and detailed.
2. Next, starting from the bottom, unroll the underlayment, black side out, mechanically fastening top and bottom, 2’-0” o.c.
3. Seal against jambs of openings with double-sided tape.
4. Vertical laps shall be a minimum of 6” with taped joints or 12” without tape. Horizontal laps shall be a minimum of 6”.

3.5 FIELD QUALITY CONTROL

A. Owner will engage an independent inspector to observe substrate and installation. Inspector shall provide a written, sign-off log, on all penetrations before the underlayment is placed against them. Architect shall approve form of log before contract with inspection service is approved.

3.6 PROTECTING AND CLEANING

A. Protect installed breathable underlayment from damage due to harmful weather exposures, physical abuse, and other causes.

1. Repair torn breathable underlayment as follows:

a. Insert a full height piece of underlayment extending 12 inches horizontally beyond the damage and extend up and under the underlayment above. Mechanically attach underlayment to substrate top and bottom.

B. Remove mud and similar marks with a water scrub. If chemicals have been spilled on underlayment, treat as a tear and repair as stated above.

- END OF SECTION -

- SECTION 07 4215 -

GLASS FACADE PANEL SYSTEM

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 glass facade panel system.

1.3 RELATED SECTIONS

A. Section 05 4000 "Cold-Formed Metal Framing" for cold-formed metal framing supporting glass facade panel system.

B. Section 07 2700 “Permeable Vapor Barrier (Rain Screen)” for continuous air barrier system.

C. Section 07 4219 “Metal Plate Wall Panels” for wall plate wall panel assembly.

D. Section 07 6200 "Sheet Metal Flashing and Trim" for field-formed flashings and other sheet metal work not part of glass facade panel system.

E. Section 08 8000 “Glazing” for spandrel glass.

F. Section 08 4113 “Aluminum Framed Entrances and Storefronts”.

1.4 DEFINITION

A. Glass Façade Panel System: Glass facade panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Glass facade panel system shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Design glass facade panel system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Material Stress and Deflection

1. Normal to the plane of the wall between structural supports, deflection of the attached perimeter-framing members shall not exceed L/175 of span length or 3/4 inch; whichever is less.
2. At connection points of framing members to anchors, anchor deflection in any direction shall not exceed 1/16 inch. Where connection points are not clearly defined, maximum anchor deflection shall not exceed 1/16 inch.
3. Stresses must take into account interaction and in no case shall allowable values exceed the yield stress.
4. At 1.5 times design pressure, permanent deflection of framing members must not exceed L/100 of the span length, and components must not experience failure or gross permanent distortion. At connection points of framing members to anchors, permanent set shall not exceed 1/16 inch

D. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

E. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

F. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. (300 Pa) and not more than 12 lbf/sq. ft. (575 Pa).

1. Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage and according to AAMA 501.1.

G. Structural Performance: Provide glass facade panel system capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:

1. Wind Loads: Determine loads based on the following minimum design wind pressures:
   a. Uniform pressure of 30 lbf/sq. ft. (1436 Pa), acting inward or outward.
2. Deflection Limits: Glass facade panel system shall withstand wind loads with horizontal deflections no greater than 1/175 of the span.

H. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing 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 (Range): -12 deg F (-24 deg C), ambient; 180 deg F (100 deg C), material surfaces.

I. Seismic Racking: There shall be no failure or deterioration of the system when the unit is laterally racked to ¾" in both directions and repeated for three (3) cycles. System must pass the static water requirements as described in the *Static Water Infiltration Section 1.5 A-2* following the seismic racking.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of glass facade panel system and accessory.

B. Shop Drawings: Show fabrication and installation layouts of glass facade panel system; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory-, shop-, and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:10):
   a. Flashing and trim.
   b. Anchorage systems.

C. Samples for Initial Selection: For each type of glass facade panel system indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.
2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Glass facade panel system: 12 inches (300 mm) long by actual panel width. Include fasteners, closures, and other panel accessories fabricated into units representative of the actual system.
2. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
3. Accessories: 12-inch- (300-mm-) long Samples for each type of accessory.
4. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of glass facade panel system adjacent to joint sealants.

E. Delegated-Design Submittal: For glass facade panel system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Coordination Drawings: Exterior elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Glass facade panels and attachments.
2. Girts
3. Wall-mounted items including doors, windows, louvers, and lighting fixtures.

4. Penetrations of wall by pipes and utilities.

G. Qualification Data: For Installer, professional engineer and testing agency.

H. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

J. Field quality-control reports.

K. Maintenance Data: For glass facade panels to include in maintenance manuals.

L. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
1. Installation History: Installer shall be a firm that has at least five (5) years of experience with exterior wall applications and has successfully completed installations of similar scope and size to this project.

B. Fabricator Qualifications: Fabricator capable of providing field service representation during construction, approving acceptable installer and application method.
1. Fabrication History: Panel fabricator shall assume undivided responsibility for all components of the panel work, and shall demonstrate no less than ten (10) years successful experience of glass facade panel work similar in scope and size to this project.

C. Manufacture Qualifications: Manufacturer experience in performing work of this section that has experience with the specified materials.
1. Manufacturer of the glass material must have at least ten (10) years experience in the production of the specified material.
2. Manufacturers of the accessories and perimeter framing extrusions must have at least five (5) years experience in the production of their respective products.

D. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

E. Source Limitations: Obtain each type of glass facade panels from single source from single manufacturer.

F. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact joint sealants to joint-sealant manufacturers for testing indicated below:
1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

a. Perform tests under environmental conditions replicating those that will exist during installation.

2. Submit no fewer than nine pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule enough time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.

G. Fire-Resistance Ratings: Where indicated, provide glass facade panel system identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

H. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical wall including corner panel as shown on Drawings; approximately one bay wide by one story high by full thickness, including insulation, supports, attachments, and accessories. Include four-way joint.
2. Conduct water-spray test of mockup of glass facade panel system, testing for water penetration according to AAMA 501.2.
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.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

I. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, glass facade panel system Installer, glass facade panel system manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects panels including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to glass facade panel system installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect glass facade panel system.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for glass facade panel system during and after installation.
8. Review glass facade panel system observation and repair procedures after installation.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, glass facade panels and other manufactured items so as not to be damaged or deformed. Package panels for protection during transportation and handling.

B. Unload, store, and erect glass facade panel system in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack glass facade panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store panels to ensure dryness, with positive slope for drainage of water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on glass façade panels for period of installation.

1.9 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of glass facade panel system to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before glass facade panel system fabrication and indicate measurements on Shop Drawings.

1.10 COORDINATION

A. Coordinate glass facade panel system with rain drainage work, flashing, trim, and construction of studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of glass facade panel system that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures, including rupturing, cracking, or puncturing.
      b. Deterioration of metals and other materials beyond normal weathering.
   2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS FAÇADE PANEL SYSTEM

A. Basis-of-Design Fabricator: “CSP” Architectural Glass Panels as manufactured by C/S Erectors Inc. San Ramon, CA (925) 820-8113.

1. Perimeter Extrusions: Extruded aluminum with integral weather stripping as detailed on drawings so as to provide the following essential features.
   a. Dry-joint floating glass spandrels with perimeter extrusions painted to match spandrel glass, panel joints nominal 1/2 inch.
   b. Spandrel glass, heat strength with polished edges.
   c. Maximum overall panel thickness, including the attachment shim space shall not exceed 2 inches.
   d. Extruded trims and end closures.
   e. Sadev Décor full capture stainless steel fittings, Model # 06 34 20.

B. Panel Depth: As indicated.

C. Attachment System Components: Formed from extruded aluminum.
1. Provide internal drainage system that allows individual panels to be installed and removed without disturbing adjacent panels.
2. Include manufacturer's standard subgirts, perimeter extrusions, tracks, and drainage channels, , panel clips and anchor channels.
3. Alignment Pins: Stainless steel.

D. Gaskets: Santoprene or EPDM.

E. Fasteners: Attachment of the panel system to the primary panel structural supports shall be made using Drill-Flex Fasteners by ELCO Textron, Inc.

2.2 PANEL MATERIALS

A. Spandrel Glass. Refer to Section 08 8000.

B. Panel Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in glass facade panel system and remain weathertight; and as recommended in writing by panel manufacturer.

2.3 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

B. Subgirts: Manufacturer's standard C- or Z-shaped sections, 0.064-inch (1.63-mm) nominal thickness.

C. Zee Clips: 0.079-inch (2.01-mm) nominal thickness.

D. Base or Sill Channels: 0.079-inch (2.01-mm) nominal thickness.

E. Hat-Shaped, Rigid Furring Channels:
1. Nominal Thickness: As required to meet performance requirements but not less than 0.025 inch (0.64 mm).
2. Depth: As indicated.

F. Cold-Rolled Furring Channels: Minimum 1/2-inch- (13-mm-) wide flange.
   1. Nominal Thickness: As required to meet performance requirements, but not less than 0.064 inch (1.63 mm).
   2. Depth: As indicated.
   3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch (1.02 mm).
   4. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.57-mm) diameter wire, or double strand of 0.048-inch- (1.22-mm-) diameter wire.

G. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.4 MISCELLANEOUS MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and finish indicated.

B. Panel Fasteners: Self-tapping screws; bolts and nuts; self-locking rivets and bolts; end-welded studs; and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

2.5 ACCESSORIES

A. Glass Facade Panel System Accessories: Provide components required for a complete glass facade panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal plate wall panels unless otherwise indicated.

B. Flashing and Trim: Same material, finish, and color as adjacent metal plate wall panels, minimum 0.030 inch (0.76 mm) thick unless otherwise indicated.

2.6 FABRICATION

A. General: Fabricate and finish glass facade panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate glass facade panel system in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

C. Glass Facade Panels: Fabricate panels as required to comply with deflection limits. Weld and grind panel corners smooth. Fabricate panels to the following dimensional tolerances:
   1. Length and Width: Plus or minus 0.032 inch (0.81 mm) up to 48 inches (1219 mm); 0.064 inch (1.63 mm) more than 48 inches (1219 mm).
   2. Diagonal: Plus or minus 0.1875 inch (4.76 mm).
   3. Panel Bow: Not more than 0.2 percent of panel width or length up to 0.1875 inch (4.76 mm) maximum.

4. Thickness: Plus or minus 0.008 inch (0.2 mm).
5. Squareness: 0.1875-inch (4.76-mm) difference between diagonal measurements.
6. Camber: 0.032 inch (0.81 mm).

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by glass facade panel system manufacturer.
   a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or glass facade panel system manufacturer for application, but not less than thickness of metal being secured.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

B. Mica Fluoropolymer: AAMA 2605. 2-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, glass facade panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by glass facade panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by glass facade panel manufacturer.
3. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating glass facade panel system to verify actual locations of penetrations relative to seam locations of panels before installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous glass facade panel support members and anchorage according to ASTM C 754 and panel manufacturer's written instructions.

3.3 GLASS FAÇADE PANEL SYSTEM INSTALLATION

A. General: Install glass facade panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Commence glass facade panel installation and install minimum of 300 sq. ft. (27.8 sq. m) in presence of factory-authorized representative.
2. Shim or otherwise plumb substrates receiving glass facade panels.
3. Flash and seal glass facade panel system with weather closures at perimeter of all openings. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.
4. Install flashing and trim as glass facade panel work proceeds.
5. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
6. Provide preformed weathertight escutcheons for pipe and conduit penetrating exterior walls.

B. Fasteners:

1. Aluminum Plate Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by glass facade panel system manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of glass facade panel system. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by panel manufacturer.

1. Seal glass facade panel system end laps with double beads of sealant, full width of panel. Seal side joints where recommended by panel manufacturer.

E. Attachment System, General: Install attachment system required to support glass facade panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

F. Flange-Attachment Installation: Attach glass facade panels, formed with extended perimeter flanges, to supports at locations, spacings, and with fasteners recommended by manufacturer.

1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Division 07 Section "Joint Sealants."
2. Seal horizontal and vertical joints between adjacent panels with manufacturer's standard gaskets.

G. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended by manufacturer. Attach flanges of glass facade panels to panel clips with fasteners or by welding, as recommended by manufacturer.

1. Seal horizontal and vertical joints between adjacent glass facade panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Division 07 Section "Joint Sealants."
2. Seal horizontal and vertical joints between adjacent glass facade panels with manufacturer's standard gaskets.

H. Subgirt-and-Spline Installation: Provide manufacturer's standard subgirts and splines that provide support and complete secondary drainage system, draining to the exterior at horizontal joints. Install support system at locations, spacings, and with fasteners recommended by manufacturer. Attach glass facade panels by interlocking perimeter extrusions attached to panels with subgirts and splines. Fully engage integral subgirt-and-spline gaskets and leave horizontal and vertical joints with open reveal. Terminate edge of panels flush with perimeter extrusions.

1. Install glass facade panels to allow individual panels to be installed and removed without disturbing adjacent panels.
2. Do not apply sealants to joints unless otherwise indicated on Drawings.

I. Rainscreen-Principle Installation: Provide manufacturer's standard pressure-equalized, rainscreen-principle system with vertical channel that provides support and complete secondary drainage system, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by manufacturer. Attach glass facade panels by engaging horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.

1. Install glass facade panels to allow individual panels to be installed and removed without disturbing adjacent panels.
2. Do not apply sealants to joints unless otherwise indicated on Drawings.

3.4 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete glass facade panel system assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align glass facade panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Water Penetration: Test areas of installed system indicated on Drawings for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure as defined by SEI/ASCE 7, but not less than 6.24 lbf/sq. ft. (300 Pa).

C. Water-Spray Test: After completing the installation of 75-foot- (23-m-) by-2-story minimum area of glass facade panel system assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by Architect.

D. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust completed glass facade panel system installation, including accessories.

E. Glass facade panels will be considered defective if they do not pass tests and inspections.

F. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

G. Prepare test and inspection reports.

3.7 CLEANING

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

B. After glass facade panel system installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace glass facade panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

- END OF SECTION -

- SECTION 07 4219 -

METAL PLATE WALL PANELS

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 metal plate wall panels.

1.3 RELATED SECTIONS

A. Section 05 4000 "Cold-Formed Metal Framing" for cold-formed metal framing supporting metal wall panels.

B. Section 07 6200 "Sheet Metal Flashing and Trim" for field-formed flashings and other sheet metal work not part of metal wall panel assemblies.

1.4 DEFINITION

A. Metal Plate Wall Panel Assembly: Metal plate wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete weathertight wall system.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Metal plate wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Design metal plate wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).

D. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).

E. Water Penetration under Dynamic Pressure: No evidence of water leakage when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lbf/sq. ft. (300 Pa) and not more than 12 lbf/sq. ft. (575 Pa).

1. Water Leakage: Uncontrolled water infiltrating the system or appearing on system's normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage and according to AAMA 501.1.

F. Structural Performance: Provide metal plate wall panel assemblies capable of withstanding the effects of the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:

1. Wind Loads: Determine loads based on the following minimum design wind pressures:
   a. Uniform pressure of 30 lbf/sq. ft. (1436 Pa), acting inward or outward.
2. Deflection Limits: Metal plate wall panel assemblies shall withstand wind loads with horizontal deflections no greater than 1/180 of the span.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing 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 (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal plate wall panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal plate wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory-, shop-, and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:10):
   a. Flashing and trim.
   b. Anchorage systems.

C. Samples for Initial Selection: For each type of metal plate wall panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.
2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
   1. Metal Plate Wall Panels: 12 inches (300 mm) long by actual panel width. Include fasteners, closures, and other panel accessories.
   2. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
   3. Accessories: 12-inch- (300-mm-) long Samples for each type of accessory.
   4. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of metal plate wall panels adjacent to joint sealants.

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

F. Coordination Drawings: Exterior elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Metal plate wall panels and attachments.
   2. Girts
   3. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
   4. Penetrations of wall by pipes and utilities.

G. Qualification Data: For Installer, professional engineer and testing agency.

H. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
   1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

J. Field quality-control reports.

K. Maintenance Data: For metal plate wall panels to include in maintenance manuals.

L. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

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

B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

C. Source Limitations: Obtain each type of metal plate wall panel from single source from single manufacturer.

D. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact joint sealants to joint-sealant manufacturers for testing indicated below:

1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
    a. Perform tests under environmental conditions replicating those that will exist during installation.
2. Submit no fewer than nine pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule enough time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.

E. Fire-Resistance Ratings: Where indicated, provide metal plate wall panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical wall including corner panel as shown on Drawings; approximately one bay wide by one story high by full thickness, including insulation, supports, attachments, and accessories. Include four-way joint.
2. Conduct water-spray test of mockup of metal plate wall panel assembly, testing for water penetration according to AAMA 501.2.
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.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal plate wall panel Installer, metal plate wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects panels including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal plate wall panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal plate wall panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal plate wall panel assembly during and after installation.

8. Review metal plate wall panel observation and repair procedures after installation.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal plate wall panels, and other manufactured items so as not to be damaged or deformed. Package panels for protection during transportation and handling.

B. Unload, store, and erect metal plate wall panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal plate wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store panels to ensure dryness, with positive slope for drainage of water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal plate wall panel for period of installation.

E. Protect foam-plastic insulation as follows:
1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.9 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal plate wall panels to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal plate wall panel fabrication and indicate measurements on Shop Drawings.

1.10 COORDINATION

A. Coordinate metal plate wall panel assemblies with rain drainage work, flashing, trim, and construction of studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal plate wall panel assemblies that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Structural failures, including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two 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 plate wall panels that show 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 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   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 PANEL MATERIALS

A. Aluminum Plate: ASTM B 209 (ASTM B 209M). Alloy and temper as recommended by manufacturer for application.

B. Panel Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal plate wall panels and remain weathertight; and as recommended in writing by panel manufacturer.

2.2 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

B. Subgirts: Manufacturer's standard C- or Z-shaped sections, 0.064-inch (1.63-mm) nominal thickness.

C. Zee Clips: 0.079-inch (2.01-mm) nominal thickness.

D. Base or Sill Channels: 0.079-inch (2.01-mm) nominal thickness.

E. Hat-Shaped, Rigid Furring Channels:

1. Nominal Thickness: As required to meet performance requirements but not less than 0.025 inch (0.64 mm).
2. Depth: As indicated.

F. Cold-Rolled Furring Channels: Minimum 1/2-inch- (13-mm-) wide flange.

1. Nominal Thickness: As required to meet performance requirements, but not less than 0.064 inch (1.63 mm).
2. Depth: As indicated.
3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch (1.02 mm).

4. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.57-mm) diameter wire, or double strand of 0.048-inch- (1.22-mm-) diameter wire.

G. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten miscellaneous metal framing members to substrates.

2.3 MISCELLANEOUS MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and finish indicated.

B. Panel Fasteners: Self-tapping screws; bolts and nuts; self-locking rivets and bolts; end-welded studs; and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

2.4 METAL PLATE WALL PANELS

A. Metal Plate Wall Panels: Provide factory-formed, metal plate wall panels fabricated from single sheets of metal formed into profile for installation method indicated. Include attachment system components, panel stiffeners, and accessories required for weathertight system.

B. Products: Basis-of-Design Product: The design based on CSP 550 Aluminum Plate Wall Panel System manufactured by CSP Architectural Metals San Ramon, CA , Tel: (925)-820-8113, www.csparchmetals.com.

1. Subject to compliance with requirements, provide the named product or a comparable product by one of the following manufactures:
   a. Architectural Specialty Products, Inc.
   b. Firestone - Copper Sales, Inc.; UNA-FAB
   c. CSP Architectural Metals
   d. Protean Construction Products, Inc.
2. Material: Tension-leveled, smooth aluminum sheet, ASTM B 209 (ASTM B 209M), 0.125 inch (3.18 mm) thick.
3. Panel Depth: 2 inches (51 mm).
4. Exterior Finish: Three-coat fluoropolymer or Mica fluoropolymer.
   a. Color: Match Architect's samples.

C. Attachment System Components: Formed from extruded aluminum.

1. Provide internal drainage system that allows individual panels to be installed and removed without disturbing adjacent panels.
2. Include manufacturer's standard subgirts, perimeter extrusions, tracks, and drainage channels, panel stiffeners, panel clips and anchor channels.
3. Alignment Pins: Stainless steel.

2.5 ACCESSORIES

A. Metal Plate Wall Panel Accessories: Provide components required for a complete metal plate wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of panels unless otherwise indicated.

B. Flashing and Trim: Same material, finish, and color as adjacent metal plate wall panels, minimum 0.030 inch (0.76 mm) thick unless otherwise indicated.

2.6 FABRICATION

A. General: Fabricate and finish metal plate wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate metal plate wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

C. Metal Plate Wall Panels: Fabricate panels with panel stiffeners as required to comply with deflection limits. Weld and grind panel corners smooth. Fabricate panels to the following dimensional tolerances:

1. Length and Width: Plus or minus 0.032 inch (0.81 mm) up to 48 inches (1219 mm); 0.064 inch (1.63 mm) more than 48 inches (1219 mm).
2. Diagonal: Plus or minus 0.1875 inch (4.76 mm).
3. Panel Bow: Not more than 0.2 percent of panel width or length up to 0.1875 inch (4.76 mm) maximum.
4. Thickness: Plus or minus 0.008 inch (0.2 mm).
5. Squareness: 0.1875-inch (4.76-mm) difference between diagonal measurements.
6. Camber: 0.032 inch (0.81 mm).

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal plate wall panel manufacturer.

a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal plate wall panel manufacturer for application, but not less than thickness of metal being secured.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

B. Mica Fluoropolymer: AAMA 2605. 2-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent 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.

C. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal plate wall panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal plate wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal plate wall panel manufacturer.
3. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal plate wall panels to verify actual locations of penetrations relative to seam locations of panels before installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous metal plate wall panel support members and anchorage according to ASTM C 754 and panel manufacturer's written instructions.

3.3 METAL PLATE WALL PANEL INSTALLATION

A. General: Install metal plate wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Commence metal plate wall panel installation and install minimum of 300 sq. ft. (27.8 sq. m) in presence of factory-authorized representative.
2. Shim or otherwise plumb substrates receiving metal plate wall panels.
3. Flash and seal metal plate wall panels with weather closures at perimeter of all openings. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.
4. Install flashing and trim as metal plate wall panel work proceeds.
5. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
6. Provide preformed weathertight escutcheons for pipe and conduit penetrating exterior walls.

B. Fasteners:

1. Aluminum Plate Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal plate wall panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall plate panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by panel manufacturer.

1. Seal metal plate wall panel end laps with double beads of sealant, full width of panel. Seal side joints where recommended by panel manufacturer.

E. Attachment System, General: Install attachment system required to support metal plate wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.

F. Flange-Attachment Installation: Attach metal plate wall panels, formed with extended perimeter flanges, to supports at locations, spacings, and with fasteners recommended by manufacturer.
   1. Seal horizontal and vertical joints between adjacent panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Division 07 Section "Joint Sealants."
   2. Seal horizontal and vertical joints between adjacent panels with manufacturer's standard gaskets.

G. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended by manufacturer. Attach flanges of metal plate wall panels to panel clips with fasteners or by welding, as recommended by manufacturer.
   1. Seal horizontal and vertical joints between adjacent metal plate wall panels with sealant backing and sealant. Install sealant backing and sealant according to requirements specified in Division 07 Section "Joint Sealants."
   2. Seal horizontal and vertical joints between adjacent metal plate wall panels with manufacturer's standard gaskets.

H. Subgirt-and-Spline Installation: Provide manufacturer's standard subgirts and splines that provide support and complete secondary drainage system, draining to the exterior at horizontal joints. Install support system at locations, spacings, and with fasteners recommended by manufacturer. Attach metal plate wall panels by interlocking perimeter extrusions attached to panels with subgirts and splines. Fully engage integral subgirt-and-spline gaskets and leave horizontal and vertical joints with open reveal. Terminate edge of panels flush with perimeter extrusions.
   1. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
   2. Do not apply sealants to joints unless otherwise indicated on Drawings.

I. Rainscreen-Principle Installation: Provide manufacturer's standard pressure-equalized, rainscreen-principle system with vertical channel that provides support and complete secondary drainage system, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by manufacturer. Attach metal plate wall panels by engaging horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.
   1. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
   2. Do not apply sealants to joints unless otherwise indicated on Drawings.

3.4 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal plate wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.5 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal plate wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Water Penetration: Test areas of installed system indicated on Drawings for compliance with system performance requirements according to ASTM E 1105 at minimum differential pressure of 20 percent of inward-acting, wind-load design pressure as defined by SEI/ASCE 7, but not less than 6.24 lbf/sq. ft. (300 Pa).

C. Water-Spray Test: After completing the installation of 75-foot- (23-m-) by-2-story minimum area of metal plate wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by Architect.

D. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust completed metal plate wall panel installation, including accessories.

E. Metal plate wall panels will be considered defective if they do not pass tests and inspections.

F. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

G. Prepare test and inspection reports.

3.7 CLEANING

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

B. After metal plate wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal plate wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

- END OF SECTION -

- SECTION 07 5400 -

THERMOPLASTIC MEMBRANE (TPO) ROOFING

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 Single Ply Roofing as follows:
   1. Adhered TPO membrane roofing system over the following:
      a. Lightweight concrete.
      b. Normalweight concrete.
      c. Metal deck at sloped parapet.
   2. Roof insulation over concrete.

1.3 RELATED SECTIONS

A. Section 06 1053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.

B. Section 07 2100 "Thermal Insulation" for insulation beneath the sloped parapet.

C. Section 07 6200 "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.

D. Section 07 7129 "Manufactured Roof Expansion Joints" for proprietary manufactured roof expansion-joint assemblies.

E. Section 07 9200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

F. Division 22 Section "Plumbing Systems" for roof drains.

1.4 DEFINITIONS

A. TPO: Thermoplastic polyolefin.

B. Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

C. Total System Warranty: Warranty of the entire roof system including items specified in all project specification sections in connection with the roofing system. One manufacture to warrant the total system.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.

D. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.

1. Fire/Windstorm Classification: Class 1A-60.
2. Hail Resistance: MH.

E. Energy Performance: Provide roofing system with initial emissivity not less than 0.75 when tested according to CRRC-1.

F. Energy Performance: Provide roofing system with initial Solar Reflectance Index not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

1.6 SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
2. Product Data for Credit SS 7.2: For roof materials, indicating that roof materials comply with Solar Reflectance Index requirement.

C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

D. Samples for Verification: For the following products:
   1. Sheet roofing, of color specified, including T-shaped side and end lap seam.
   2. Roof insulation.
   3. 10 lb (4.5 kg) of aggregate ballast in gradation and color indicated.
   4. Roof paver in each color and texture required.
   5. Walkway pads or rolls.
   6. Metal termination bars.
   7. Battens.
   8. Six insulation fasteners of each type, length, and finish.
   9. Six roof cover fasteners of each type, length, and finish.

E. Qualification Data: For qualified Installer and manufacturer.

F. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
   1. Submit evidence of compliance with performance requirements.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.

H. Research/Evaluation Reports: For components of membrane roofing system, from 2001 CBC..

I. Field quality-control reports.

J. Maintenance Data: For roofing system to include in maintenance manuals.

K. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for membrane roofing system identical to that used for this Project.

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

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

D. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

E. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

F. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

G. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.9 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
   1. Total System Warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories including roof pavers, and other components of membrane roofing system.
   2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, roof pavers, and walkway products, for the following warranty period:
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TPO MEMBRANE ROOFING (SINGLE PLY)

A. Basis of Design: Sure-Weld TPO, fabric-reinforced thermoplastic polyolefin sheet: ASTM D 6878, internally fabric or scrim reinforced, uniform, flexible fabric backed TPO sheet as manufactured by Carlise SynTec Incorporated, or subject to compliance with requirements, provide products by one of the following:
   1. Carlisle SynTec Incorporated.
   2. Firestone Building Products Company.
   3. GAF Materials Corporation.
   4. Stevens Roofing Systems; Division of JPS Elastomerics.

B. Properties:
   1. Thickness: 72 mils (1.8 mm), nominal.
   2. Exposed Face Color: White.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.
   1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
   2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      a. Plastic Foam Adhesives: 50 g/L.
      b. Gypsum Board and Panel Adhesives: 50 g/L.
      c. Multipurpose Construction Adhesives: 70 g/L.
      d. Fiberglass Adhesives: 80 g/L.
      e. Contact Adhesive: 80 g/L.
      f. Other Adhesives: 250 g/L.
      g. Single-Ply Roof Membrane Sealants: 450 g/L.
      h. Nonmembrane Roof Sealants: 300 g/L.
      i. Sealant Primers for Nonporous Substrates: 250 g/L.
      j. Sealant Primers for Porous Substrates: 775 g/L.

B. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheet flashing, 55 mils (1.4 mm) thick, minimum, of same color as sheet membrane.

C. Bonding Adhesive: Manufacturer's standard, water based.

D. Slip Sheet: Manufacturer's standard, of thickness required for application.

E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.

F. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick), prepunched.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane 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.

2.3 SUBSTRATE BOARDS

A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 1/4 inch (6 mm) thick.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Georgia-Pacific Corporation; Dens Deck.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

2.4 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by TPO membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.6-lb/cu. ft. (26-kg/cu. m) minimum density, square edged.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.5 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and 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.

C. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

D. Cover Board: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch (13 mm) thick.

2.6 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 5 Section "Steel Deck."

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 SUBSTRATE BOARD

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

3.4 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

1. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

G. Mechanically Fastened and Adhered Insulation: Install each layer of insulation and secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten first layer of insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
2. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
3. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
4. Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
5. Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

H. 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 (150 mm) in each direction. Loosely butt cover boards together.

1. Fasten cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
2. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

I. Install slip sheet over cover board and immediately beneath membrane roofing.

3.5 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.

B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.

E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.

F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions 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 sheet membrane.
   2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
   3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

H. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

3.6 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane 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.

3.7 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

B. Roof-Paver Walkways: Install walkway roof pavers according to manufacturer's written instructions in locations indicated, to form walkways. Leave 3 inches (75 mm) of space between adjacent roof pavers.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

C. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

D. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTING AND CLEANING

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

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane 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.

3.10 ROOFING INSTALLER'S WARRANTY

A. WHEREAS <Insert name> of <Insert address>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <Insert name of Owner>.
2. Address: <Insert address>.
3. Building Name/Type: <Insert information>.
4. Address: <Insert address>.
5. Area of Work: <Insert information>.
6. Acceptance Date: <Insert date>.
7. Warranty Period: <Insert time>.
8. Expiration Date: <Insert date>.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
   a. Lightning;
   b. Peak gust wind speed exceeding <Insert wind speed> mph (m/sec);
   c. Fire;
   d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
   e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
   f. Vapor condensation on bottom of roofing; and
   g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.

1. Authorized Signature: <Insert signature>.
2. Name: <Insert name>.
3. Title: <Insert title>.

- END OF SECTION -

- SECTION 07 6200 -

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes sheet metal flashing and trim in the following categories:
   1. Roof-drainage systems.
   2. Metal flashing.
   3. Reglets.
   4. Overhead-piping safety pans.
   5. Counterflashings over bituminous base flashing.
   6. Counterflashings at roof mounted equipment and vent stacks.
   7. Counterflashings at walls and penetrations.
   8. Lead flashing for bituminous membranes.
   9. Extruded metal reveal trim
   10. Other components.

1.3 RELATED SECTIONS

A. Section 07 4215 “Glass Façade Panel System” for sheet metal flashing and trim integral with glass façade panel system.

B. Section 07 4219 “Metal Plate Wall Panels” for sheet metal flashing and trim integral with metal wall panels.

C. Section 07 5400 “Thermoplastic Membrane (TPO) Roofing” to be installed in conjunction with roofing system by same installer and warranty.

D. Section 07 7129 “Manufactured Roof Expansion Joints” manufactured sheet metal expansion-joint covers.

E. Section 07 7100 “Roof Specialties” for manufactured roof specialties not part of sheet metal flashing and trim.

F. Section 07 7200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

G. Section 07 9200 "Joint Sealants" for elastomeric sealants.

H. Section 07 9500 "Expansion Control" for manufactured sheet metal expansion-joint covers.

1.4 REFERENCES

ASTM A-446	Specification for steel sheet
ASTM A792	Steel Sheet, Aluminum-Zinc Alloy-Coated, by the Hot-Dip Process
ASTM B32	Solder Metal
ASTM B486	Paste Solder
ASTM D226	Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D486	Asphalt Roof Cement, Asbestos-free
FS O-F-506	Flux, Soldering, Paste and Liquid
WH	Warnock Hersey International, Inc. Middleton, WI.
FM	Loss Prevention Data Sheet
NRCA	National Roofing Contractors Association - Roofing Manual
SMACNA	Architectural Sheet Metal Manual

1.5 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing.

B. Fabricate and install flashings at roof edges to comply with recommendations of FM Loss Prevention Data Sheet 1-49 for the following wind zone:

1. Wind Zone 1: Wind pressures of 21 to 30 psf (1.00 to 1.44 kPa).

1.6 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Specification Section 01 3219.

B. Product Data including manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.

1. Metal material characteristics and installation recommendations.
2. Submit color chart prior to material ordering and/or fabrication so that equivalent colors to those specific can be approved
3. Provide approval letters from metal manufacturer for use of their metal within this particular roofing system type.

C. Shop Drawings of each item specified showing layout, profiles, methods of joining, and anchorage details.

1. For manufactured and shop fabricated edge metal, fascia, scuppers, and all other sheet metal fabrications.
2. Indicate material profile, jointing pattern, jointing details, fastening methods, flashing, termination's, and installation details.
3. Indicate type, gauge and finish of metal.

D. Submit two samples, 12 x 12 inch in size illustrating typical external corner, internal corner, valley, junction to vertical dissimilar surface, material and finish

E. Samples of sheet metal flashing, trim, and accessory items, in the specified finish. Where finish involves normal color and texture variations, include Sample sets composed of 2 or more units showing the full range of variations expected.

1. 8-inch- (200-mm-) square Samples of specified sheet materials to be exposed as finished surfaces.
2. 12-inch- (300-mm-) long Samples of factory-fabricated products exposed as finished Work. Provide complete with specified factory finish.

F. Certification

1. Submit roof manufacturer's certification that metal fasteners furnished are acceptable to roof manufacturer.
2. Submit roof manufacturer's certification that metal furnished is acceptable to roofing manufacturer as a component of roofing system and is eligible for roof manufacturer's system warranty.

G. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a minimum 5 year fabrication and installation record of successful in-service performance.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

C. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.
5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers or packages with labels intact and legible.

B. Stack performed and pre-finished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials which may cause discoloration or staining.

1.9 WARRANTY

A. Manufacturer's Warranty

1. Pre-finished metal material shall require a written 20-year non-prorated warranty covering fade, chalking and film integrity. The material shall not show a color change greater than 5 NBS color units per ASTM D-2244 or chalking excess of 8 units per ASTM D-659. If either occurs material shall be replaced per warranty, at no cost to the Owner.

B. Contractor's Warranty

1. The Contractor shall provide the Owner with a notarized written warranty assuring that all sheet metal work including caulking and fasteners to be water-tight and secure for a period of five years from the date of final acceptance of the building. Warranty shall include all materials and workmanship required to repair any leaks that develop, and make good any damage to other work or equipment caused by such leaks or the repairs thereof.

1.10 PROJECT CONDITIONS

A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

PART 2 - PRODUCTS

2.1 METALS

A. Aluminum Sheet: 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. As-Milled Finish: Mill finish.
2. Alclad Finish: Metallurgically bonded surfacing to both sides, forming a composite aluminum sheet with reflective luster.
3. Surface: Smooth, flat.
4. Factory Prime Coating: Where painting after installation is indicated, pretreat with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of 0.2 mil (0.005 mm).
5. Exposed Coil-Coated Finishes:
   a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent 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.
   b. Color: As selected by Architect from manufacturer's full range.

6. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

B. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed.

C. Galvanized Steel Sheet: ASTM A 526, G 90 (ASTM A 526M, Z 275), commercial quality, or ASTM A 527, G 90 (ASTM A 527M, Z 275), lock-forming quality, hot-dip galvanized steel sheet with 0.20 percent copper, mill phosphatized where indicated for painting; not less than 0.0396 inch (1.0 mm) thick, unless otherwise indicated.

D. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, Class AZ-50 coating, Grade 40 (ASTM A 792M, Class AZ-150 coating, Grade 275) or to suit project conditions, with 55 percent aluminum, not less than 0.0396 inch (1.0 mm) thick, unless otherwise indicated.

E. Coil-Coated Galvanized Steel Sheet: Zinc-coated, commercial-quality steel sheet conforming to ASTM A 755, G 90 (ASTM A 755M, Z 275) coating designation, coil coated with high-performance fluoropolymer coating as specified in "Coil-Coated Galvanized Steel Sheet Finish" Article; not less than 0.0336 inch (0.85 mm) thick, unless otherwise indicated.

2.2 UNDERLAYMENT MATERIALS

A. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, non-perforated.

B. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).

2.3 REGLETS

A. General: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces and compatible with flashing indicated.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
   a. Cheney Flashing Company, Inc.
   b. Fry Reglet Corporation.
   c. Heckmann Building Products Inc.
   d. Hickman, W. P. Company.
   e. Keystone Flashing Company, Inc.
   f. Sandell Manufacturing Company, Inc.

B. Material: Galvanized steel, 0.0217 inch (0.55 mm) thick.

C. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

D. Stucco Type: Provide with minimum 3 inch upturned fastening flange and extension leg of length to match thickness of applied finish materials.

E. 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 Drawings show reglet without metal counterflashing.

F. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of the counterflashing lower edge.
1. Material: Stainless steel, 0.0187 inch (0.5 mm) thick.
2. Material: Copper, 16 oz./sq. ft. (0.55 mm thick).
3. Material: Aluminum, 0.024 inch (0.6 mm) thick.
4. Material: Galvanized steel, 0.0217 inch (0.55 mm) thick.

G. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.

2.4 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Solder: ASTM B 32, Grade Sn50, used with rosin flux.

B. Solder for Stainless Steel: ASTM B 32, Grade Sn60, used with an acid flux of type recommended by stainless-steel sheet manufacturer; use a noncorrosive rosin flux over tinned surfaces.

C. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.

D. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil (0.4-mm) dry film thickness per coat.

E. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

F. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealants."

G. Epoxy Seam Sealer: 2-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior and interior nonmoving joints, including riveted joints.

H. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.

I. Paper Slip Sheet: 5-lb/square (0.244 kg/sq. m) red rosin, sized building paper conforming to FS UU-B-790, Type I, Style 1b.

J. Polyethylene Underlayment: ASTM D 4397, minimum 6-mil- (0.15-mm-) thick black polyethylene film, resistant to decay when tested according to ASTM E 154.

K. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

L. Gutter Screen: 1/4-inch (6-mm) hardware cloth installed in sheet metal frames. Fabricate screen and frame of same basic material as gutters and downspouts.

M. Roofing Cement: ASTM D 4586, Type I, asbestos free, asphalt based.

N. Gutter and sump drain bulbs: Stainless steel wire type. Heaviest gauge available

O. Nailers: 2x pressure treated Douglas fir

2.5 FABRICATION, GENERAL

A. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.

B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Form exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.

D. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.

E. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

2.6 SHEET METAL FABRICATIONS

A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.

B. Splash Pans: Fabricate from the following materials:
1. Lead-Coated Copper: 16 oz./sq. ft. (0.55 mm thick).
2. Stainless Steel: 0.0187 inch (0.5 mm) thick.
3. Terne-Coated Stainless Steel: 0.018 inch (0.5 mm) thick.

C. Drip Edges: Fabricate from the following material:
1. Galvanized Steel: 0.0217 inch (0.55 mm) thick.
2. Coil-Coated Galvanized Steel: 0.0217 inch (0.55 mm) thick.

D. Equipment Support Flashing: Fabricate from the following material:
1. Galvanized Steel: 0.0276 inch (0.7 mm) thick.
2. Coil-Coated Galvanized Steel: 0.0276 inch (0.7 mm) thick.

E. Overhead-Piping Safety Pans: Fabricate from the following material:
1. Galvanized Steel: 0.0396 inch (1.0 mm) thick.

2.7 ALUMINUM EXTRUSION FABRICATIONS

A. Aluminum Extrusion Units: Fabricate extruded-aluminum running units with formed or extruded-aluminum joint covers for installation behind main members where possible. Fabricate mitered and welded corner units.
1. Pre-finish gypsum board, and exterior plaster reveals to match adjacent surfaces.

2.8 ALUMINUM FINISHES

A. General: Comply with Aluminum Association's (AA) "Designation System for Aluminum Finishes" for finish designations and application recommendations.
1. High-Performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's instructions.
a. Color and Gloss: As selected by Architect from manufacturer's full range of choices for color and gloss.

2.9 COIL-COATED GALVANIZED STEEL SHEET FINISH

A. High-Performance Organic Coating Finish: Apply the following system by coil-coating process on galvanized steel sheet as recommended by coating manufacturers and applicator.
1. Fluoropolymer 2-Coat Coating System: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.
a. Color and Gloss: As selected by Architect from manufacturer's full range of choices for color and gloss.
2. Resin Manufacturers: Subject to compliance with requirements, provide fluoropolymer coating systems containing resins produced by one of the following manufacturers:
a. Elf Atochem North America, Inc. (Kynar 500)

B. Coil-Coated Steel Sheet Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
1. Atlas Aluminum Corporation.
2. Copper Sales, Inc.
3. Kovach
4. MM Systems Corporation.
5. Petersen Aluminum Corporation.
6. Vincent Metals.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PROTECTION

A. Protect contact areas of dissimilar metals with heavy asphalt or other approved coating, specifically made to stop electrolytic action.

3.3 MANUFACTURED SHEET METAL SYSTEMS

A. Installing Contractor shall be responsible for determining if the sheet metal systems are in general conformance with roof manufacturer's recommendations.

B. Furnish and install manufactured sheet metal systems in strict accordance with manufacturer's printed instructions.

C. Provide all factory-fabricated accessories including, but not limited to, fascia extenders, miters, scuppers, joint covers, etc

3.4 SHOP FABRICATED SHEET METAL SYSTEMS

A. Installing Contractor shall be responsible for determining if the sheet metal systems are in general conformance with roof manufacturer's recommendations.

B. Metal work shall be shop fabricated to configurations and forms in accordance with recognized sheet metal practices.

C. Hem exposed edges.

D. Angle bottom edges of exposed vertical surfaces to form drip.

E. All corners for sheet metal shall be lapped with adjoining pieces fastened and set in sealant.

F. Joints for fascia system, cap flashing, and surface-mount counterflashing shall be formed with a 1/4” opening between sections. The opening shall be covered by a cover plate or backed by an internal drainage plate formed to the profile of fascia piece. The cover plate shall be embedded in mastic, fastened through the opening between the sections and loose locked to the drip edges.

3.5 UNDERLAYMENT INSTALLATION

A. General: Install underlayment as indicated on Drawings.

B. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).

3.6 INSTALLATION, GENERAL

A. Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Roof-Edge Flashings: Secure metal flashings at roof edges according to FM Loss Prevention Data Sheet 1-49 for specified wind zone.

D. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

E. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except where pretinned surface would show in finished Work.

1. Do not solder the following metals:
   a. Aluminum.
   b. Coil-coated galvanized steel sheet.
2. 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.

F. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.

1. Use joint adhesive for nonmoving joints specified not to be soldered.

G. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.

H. Separations: Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.

1. Underlayment: Where installing stainless steel or aluminum directly on cementitious or wood substrates, install a slip sheet of red-rosin paper and a course of polyethylene underlayment.
2. Bed flanges of Work in a thick coat of roofing cement where required for waterproof performance.

I. Install reglets to receive counterflashing according to the following requirements:
1. Where reglets are shown in concrete, furnish reglets for installation under Division 3 Section "Cast-in-Place Concrete."

J. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of 2 inches (50 mm) and bed with sealant.

K. Fascia: Metal fascia and copings shall be secured to wood nailers at the bottom edge with a continuous cleat. Cleats shall be at least one gauge heavier than the metal it secures

L. Roof-Drainage System: Install drainage items fabricated from sheet metal, with straps, adhesives, and anchors recommended by SMACNA's Manual or the item manufacturer, to drain roof in the most efficient manner. Coordinate roof-drain flashing installation with roof-drainage system installation. Coordinate flashing and sheet metal items for steep-sloped roofs with roofing installation.

M. Overhead-Piping Safety Pans: Suspend pans from pipe and install drain line to plumbing waste or drain line.

N. Equipment Support Flashing: Coordinate equipment support flashing installation with roofing and equipment installation. Weld or seal flashing to equipment support member.

O. Roof-Penetration Flashing: Coordinate roof-penetration flashing installation with roofing and installation of items penetrating roof. Install flashing as follows:

P. Install continuous gutter screens on gutters with noncorrosive fasteners, arranged as hinged units to swing open for cleaning gutters.

3.7 INSPECTION

A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets are in place, and nailing strips located.

B. Verify membrane termination and base flashings are in place, sealed, and secure.

C. Beginning of installation means acceptance of existing conditions.

D. Field measure site conditions prior to fabricating work.

3.8 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

B. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion

- END OF SECTION -

- SECTION 07 7100 -

ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following manufactured roof specialties:

1. Counterflashings and reglets.

1.3 RELATED SECTIONS

A. Section 06 1053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.

B. Section 07 6200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.

C. Section 07 7129 "Manufactured Roof Expansion Joints" for manufactured roof expansion-joint cover assemblies.

D. Section 07 7200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

E. Section 07 9200 "Joint Sealants" for field-applied sealants.

1.4 PERFORMANCE REQUIREMENTS

A. General: Manufacture and install manufactured roof specialties to resist thermally induced movement and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Thermal Movements: Provide manufactured roof specialties that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing 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 engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

C. Water Infiltration: Provide manufactured roof specialties that do not allow water infiltration to building interior.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of manufactured roof specialties, including plans and elevations. Identify factory- vs. field-assembled work. Include the following:

1. Details for fastening, joining, supporting, and anchoring manufactured roof specialties including fasteners, clips, cleats, and attachments to adjoining work.
2. Details for expansion and contraction.

C. Samples for Initial Selection: For each type of manufactured roof specialty indicated with factory-applied color finishes.

D. Fabrication Samples: For counterflashings and reglets made from 12-inch (300-mm) lengths of full-size components including fasteners, cover joints, accessories, and attachments.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, verifying compliance of opings with performance requirements.

F. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. 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. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

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

1.7 COORDINATION

A. Coordinate installation of manufactured roof specialties with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

1.8 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace manufactured 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 D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      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 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 EXPOSED METALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.
   1. Surface: Smooth, flat finish.
   2. Exposed Coil-Coated Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      a. Two-Coat Fluoropolymer: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.
      b. Concealed Surface: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:
   1. Exposed 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. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

C. Prepainted, Zinc-Coated Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation, structural quality, and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Surface: Smooth, flat finish.
2. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2605, except as modified below:
      1) Humidity Resistance: 2000 hours.
      2) Salt-Spray Resistance: 1000 hours.

2.3 CONCEALED METALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by manufacturer for use and structural performance indicated, mill finished.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

D. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, separators, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.

C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

D. Elastomeric Sealant: ASTM C 920, 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 C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

H. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.

I. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
1. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).

2.5 COUNTERFLASHINGS AND REGLETS

A. Available Manufacturers:
1. Castle Metal Products.
2. Cheney Flashing Company.
3. Fry Reglet Corporation.
4. Hickman, W. P. Company.
5. Keystone Flashing Company.
6. Merchant & Evans, Inc.
7. Metal-Era, Inc.
8. MM Systems Corporation.

B. Counterflashings: Manufactured units in lengths not exceeding 12 feet (3.6 m) designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal in thickness indicated:
1. Prepainted, Zinc-Coated Steel: 0.028 inch (0.7 mm) thick.

C. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashings indicated, from the following exposed metal in thickness indicated:
1. Prepainted, Zinc-Coated Steel: 0.028 inch (0.7 mm) thick.
2. Type: Surface-mounted with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
3. Type: For stucco application, with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
4. Type: For concrete application with temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.

D. Accessories: Counterflashing wind-restraint clips.

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.

1. Examine walls, roof edges, and parapets for suitable conditions for manufactured roof specialties.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install manufactured roof specialties according to manufacturer's written instructions. Anchor manufactured roof specialties securely in place and capable of resisting forces specified in performance requirements. Use fasteners, separators, sealants, and other miscellaneous items as required to complete manufactured roof specialty systems.

1. Install manufactured roof specialties with provisions for thermal and structural movement.
2. Torch cutting of manufactured roof specialties is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of manufactured roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing exposed-to-view components of manufactured roof specialties directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Install manufactured roof specialties level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil-canning, buckling, or tool marks.

D. Install manufactured roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.

E. Expansion Provisions: Provide for thermal expansion of exposed manufactured roof specialties. Space movement joints at a maximum of 12 feet (3.6 m) with no unplanned joints within 18 inches (450 mm) of corners or intersections.

F. Fasteners: Use fasteners of type and size recommended by manufacturer but of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

G. Seal joints with elastomeric sealant as required by manufacturer of roofing specialties.

3.3 COUNTERFLASHING AND REGLET INSTALLATION

A. Counterflashings: Coordinate installation of counterflashings with installation of base flashings. Insert counterflashings in reglets or receivers and fit tightly to base flashings. Extend counterflashings 4 inches (100 mm) over base flashings. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with elastomeric sealant.

3.4 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 manufactured roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace manufactured roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

- END OF SECTION -

- SECTION 07 7129 -

MANUFACTURED ROOF EXPANSION JOINTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Aluminum roof expansion assemblies.

1.3 RELATED SECTIONS

A. Section 06 1053 "Miscellaneous Rough Carpentry" for wooden curbs for mounting roof expansion assemblies.

B. Section 07 5400 “Thermoplastic Membrane (TPO) Roofing” for coordination with single ply membrane roofing system.

C. Section 07 6200 "Sheet Metal Flashing and Trim" for shop and field-fabricated sheet metal expansion-joint systems, flashing, and other sheet metal items.

D. Section 07 7100 "Roof Specialties" for other manufactured roof items.

E. Section 07 8446 "Fire-Resistive Joint Systems" for fire-resistive joint systems in construction other than roofs.

F. Section 07 9500 “Expansion Control” for building exterior and interior expansion joint systems.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide roof expansion assemblies that, when installed, remain watertight within movement limitations specified by manufacturer.

1.5 SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, joints, splices, locations of joints and splices, intersections, transitions, fittings, and attachments to other work. Where joint assemblies change planes, provide isometric drawings depicting how components interconnect to achieve continuity.

C. Samples: For each type of exposed factory-applied finish required, prepared on Samples of size to adequately show color.

D. Research/Evaluation Reports: For roof expansion assemblies.

E. Warranties: Special warranties specified in this Section.

F. Qualification Data: For Installer.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer of roof membrane.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of roof expansion assemblies and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

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

C. Fire-Test-Response Characteristics: Provide fire-barrier assemblies with fire-test-response characteristics not less than that of adjacent construction, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Assemblies shall be capable of anticipated movement while maintaining fire rating. Identify assemblies with appropriate markings of applicable testing and inspecting agency.

1. Fire-Resistance Ratings: UL 2079.
2. Fire-Resistance Ratings: ASTM E 119.

1.7 SCHEDULING

A. Coordinate delivery and installation of roof expansion assemblies to prevent damage and provide timely integration of units with roofing membranes and flashing.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace roof expansion assemblies that leak, deteriorate in excess of rates specified in manufacturer's published product literature, or otherwise fail to perform within specified warranty period.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 METALS

A. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness, minimum 0.015 inch (0.4 mm) thick.

B. Sheet Aluminum: ASTM B 209 (ASTM B 209M); Alloy 3003-H14, 5052-H32, or 6061-T6; minimum 0.032 inch (0.8 mm) thick.

C. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 or 6063-T52, minimum 0.040 inch (1.0 mm) thick.

D. Aluminum Finishes:

1. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 and with coating and resin manufacturers' written instructions.

a. Color and Gloss: As selected by Architect from manufacturer's full range.

2.3 MISCELLANEOUS MATERIALS

A. Roof Cement: ASTM D 4586, Type II.

B. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and to remain watertight.

C. Mineral-Fiber Blanket: ASTM C 665.

D. Flexible Cellular Sponge or Expanded Rubber: ASTM D 1056.

E. Silicone Extrusions: Classified according to ASTM D 2000, UV stabilized, and do not propagate flame.

F. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.

2.4 FIRE BARRIERS

A. Fire Barriers: Devices complying with requirements specified in Part 1 "Quality Assurance" Article for fire-test-response characteristics and designed for dynamic structural movement without material degradation or fatigue when tested according to ASTM E 1399. Provide roof expansion assemblies with manufacturer's continuous, standard, flexible fire-barrier seals in back of joint system at locations indicated to provide fire-resistance rating not less than rating of adjacent construction.

2.5 ALUMINUM ROOF EXPANSION ASSEMBLIES

A. Aluminum Roof Expansion Assemblies: Provide assemblies consisting of aluminum base members with sloped cants and provisions for anchoring and sealing to roofing membrane or flashing in a waterproof-sealed joint. Provide free-to-move, extruded-aluminum cover plate anchored against displacement and waterproofed by integral seals. Provide prefabricated units for corner and joint intersections and horizontal and vertical transitions, including those to other building expansion joints, splicing units, adhesives, coatings, and other components as recommended by roof expansion assembly manufacturer for complete installation. Fabricate assemblies specifically for curb-to-curb and curb-to-wall applications.

1. Basis-of-Design Product: The design based on Models SRJW-1-001 as manufactured by the C/S Group Muncy, PA tel: (570) 546-5941, web: www.c-sgroup.com, or subject to compliance with requirements, provide the named product or a comparable product by one of the following manufacturers
   a. Balco Metalines, a division of Balco, Inc..
   b. C/S Group; Model.
   c. Hickman, W. P. Company;
   d. JointMaster, a division of InPro Corporation.
   e. MM Systems Corporation.
   f. Nystrom, Inc.
2. Base Frame Members: Extruded aluminum with high-performance organic finish.
3. Formed-Aluminum Covers: Minimum 0.078 inch (2 mm) thick, with high-performance organic finish.
   a. Aluminum Seismic Roof Cover Assembly: Roof-to-roof and roof-to-wall aluminum covers held in place by stainless steel seismic turnbar assembly 24" o.c. for max. 16" joint width. Joint system to be capable of plus and minus 7” seismic movement..
   b. Frames to incorporate adjustable angle flange folded on site to cover adjacent edge of roof membrane. All transitions and end caps to be factory fabricated to ensure maximum weather tightness. All butt joints to be sealed with aluminum splice cover bedded on caulk and fastened on one side only.
4. Moisture Barrier: Semiconcealed, captive gaskets at both curb members, of neoprene, EPDM, or PVC, with spring-loaded mechanism to maintain positive pressure between gaskets and curb cap.
5. Fire Barrier: Provide manufacturer's standard fire barrier.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for handling and installing roof expansion assemblies and materials unless more stringent requirements are indicated.

B. Coordinate installation of roof expansion assembly materials and associated work so complete assemblies comply with assembly performance requirements.

C. Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of roof expansion assembly, including transitions and end joints.

D. Extend roof expansion assemblies over curbs, and other elements in the construction profile, with factory-fabricated intersections and transitions to provide continuous, uninterrupted, waterproof roof expansion assemblies.

1. Install factory-fabricated transitions between roof expansion assemblies and building architectural joint systems, specified in Division 7 Section "Expansion Control," to provide continuous, uninterrupted, watertight construction.

E. Splice roof expansion assemblies with materials provided by roof expansion assembly manufacturer for this purpose, according to manufacturer's written instructions, to provide continuous, uninterrupted, waterproof roof expansion assemblies.

F. Provide uniform profile of roof expansion assembly throughout length of each installation; do not stretch polymeric sheets.

G. Install mineral-fiber blanket insulation to fill joint space within joint and moisture barrier.

H. Anchor roof expansion assemblies complying with manufacturer's written instructions.

I. On single-ply roofing, install roof expansion assemblies complying with manufacturer's written instructions. Anchor to cants or curbs and seal to membrane with sealant compatible with roofing membrane and roof expansion assembly.

3.2 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensures that roof expansion assemblies are without damage or deterioration at time of Substantial Completion.

- END OF SECTION -

- SECTION 07 7200 -

ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Pre-manufactured Roof Curbs.
   2. Pre-manufactured Roof Hatches, safety posts and safety railings.

1.3 RELATED WORK

A. Section 05 1200 “Structural Steel Framing”.

B. Section 05 5000 “Metal Fabrication” for ships’ ladder for access to roof hatch.

C. Section 07 5400 “Thermoplastic Membrane (TPO) Roofing” for roofing systems and conditions.

D. Section 07 6200 “Sheet Metal Flashing and Trim” for required flashing at roof.

E. Section 09 9113 “Exterior Painting” for painting unfinished roof flashing and roof accessories.

F. Division 23 “Mechanical” to coordinate sizes of pre-manufactured roof curbs.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, materials, dimensions of individual components and profiles, and finishes.

B. Shop Drawings for Prefabricated Curbs: Show fabrication and installation details. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other Work.

1.5 QUALITY ASSURANCE

A. Standards: Comply with the following:
   1. SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.
   2. NRCA's "Roofing and Waterproofing Manual" details for installing units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Roof Curbs:
      a. Roof Products & Systems Corp.
      b. ThyCurb, Inc.
   2. Roof Hatches:
      a. MATERIALS Basis-of-Design Product: The design is based on Type NB Roof Scuttle manufactured by The Bilco Company, New Haven, CT, tel: (203) 934-6363, web: www.bilco.com .
      b. Subject to compliance with requirements, provide the named product or a comparable product by one of the following manufactures:
         1) O'Keeffe's Inc.
         2) Dur-Red Products, Inc.
         3) Milcor, Inc.
         4) ThyCurb, Inc,

2.2 MATERIALS, GENERAL

A. Aluminum Sheet: ASTM B 209 for alclad alloy 3005H25 or alloy and temper required to suit forming operations, with mill finish, unless otherwise indicated.

B. Extruded Aluminum: ASTM B 221 alloy 6063-T52 or alloy and temper required to suit structural and finish requirements, with mill finish, unless otherwise indicated.

C. Galvanized Steel Sheet: ASTM A 653 with G90 coating designation; commercial quality, unless otherwise indicated.
   1. Structural Quality: Grade 40, where indicated or as required for strength.

D. Insulation: Manufacturer's standard rigid or semirigid glass-fiber board of thickness indicated.

E. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA C2; not less than 1-1/2 inches thick.

F. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened.

1. Where removing exterior exposed fasteners affords access to building, provide nonremovable fastener heads.

G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.

H. Bituminous Coating: SSPC-Paint 12, solvent-type bituminous mastic, nominally free of sulfur and containing no asbestos fibers, compounded for 15-mil dry film thickness per coating.

I. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

J. Elastomeric Sealant: Generic type recommended by unit manufacturer that is compatible with joint surfaces; ASTM C 920, Type S, Grade NS, Class 25, and Uses NT, G, A, and, as applicable to joint substrates indicated, O.

K. Roofing Cement: ASTM D 4586, nonasbestos, fibrated asphalt cement designed for trowel application or other adhesive compatible with roofing system.

2.3 ROOF CURBS

A. General: Provide roof curbs capable of supporting superimposed live and dead loads, including equipment loads and other construction to be supported on roof curbs. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

B. Fabrication: Unless otherwise indicated or required for strength, fabricate units from minimum 0.0747-inch-thick (14 gage), structural-quality, hot-dip galvanized steel sheet; factory primed and prepared for painting with corner joints mitered and fully welded.

1. Shop prime welded connections with zinc-rich paint complying with SSPC-Paint 20.
2. Structurally reinforce curb sections 24 inches o.c. at bulkheads.
3. Provide preservative-treated wood nailers at tops of curbs. Nailer for roof curb shall be nominal 2" x 2". Nailer for equipment support curb shall be nominal 2" x 4" or other width as required.
4. Provide manufacturer's standard rigid or semirigid insulation where indicated.
5. Fabricate units to typical height of 9 inches, as measured from top of roof membrane to top of curb, unless otherwise indicated.
6. Sloping Roofs: Where slope of roof deck exceeds 1/4 inch per foot, fabricate curb units with height tapered to match slope to level tops of units.
7. Curb models for this Project include, but are not limited to, the following Custom Curb designations:
   a. Typical roof curb: CRC-3
   b. Equipment support curb: CES-3
   c. Platform curbs: CPF-3
   d. Pipe accessories: Vertical pipe curb, pipe box and roller support.

2.4 ROOF HATCHES

A. General: Fabricate units to withstand 40-lbf/sq. ft. external and 20-lbf/sq. ft. internal loading pressure. Frame with minimum 12-inch-high, integral-curb, double-wall construction with 1-1/2-inch insulation, formed cants and cap flashing (roofing counterflashing), with welded mechanical corner joints. Provide double-wall cover (lid) construction with 1-inch-thick insulation core. Provide gasketing and equip with corrosion-resistant or hot-dip galvanized hardware including pintle hinges, hold-open devices, interior padlock hasps, and both interior and exterior latch handles. Provide Bilco “LadderUp” safety post at each roof hatch

B. Type: Single-leaf personnel access.
   1. For Ships’ Ladder Access: 30 by 54 inches.

C. Material: Galvanized steel sheets.
   1. Finish: Prime painted.

D. Sloping Roofs: Where slope or roof deck exceeds 1/4 inch per foot, fabricate hatch curbs with height tapered to match slope to level tops of units.

E. Safety Railing System: Manufacturer's standard complete system including rails, clamps, fasteners, safety barrier at railing opening, and all accessories required for a complete installation.
   1. Height: 42 inches (1060 mm) above finished roof deck.
   2. Pipe or Tube: 1-1/4-inch (31-mm) ID galvanized pipe or 1-5/8-inch (41-mm) OD galvanized tube.
   3. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
   4. Pipe Ends and Tops: Covered or plugged with weather-resistant material.
   5. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members that are exposed to exterior or to moisture from condensation or other sources.
   6. Fabricate joints that will be exposed to weather in a watertight manner.
   7. Close exposed ends of handrail and railing members with prefabricated end fittings.

F. Fasteners: Manufacturer's standard.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 GALVANIZED STEEL SHEET FINISHES

A. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

B. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply the air-dried primer specified below immediately after cleaning and pretreating.

1. Shop Primer: Exterior galvanized metal primer per Division 9 Section "Exterior Painting."

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written instructions. Coordinate installation of roof accessories with installation of roof deck, roof insulation, flashing, roofing membranes, penetrations, equipment, and other construction involving roof accessories to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight. Anchor roof accessories securely to supporting structural substrates so they are capable of withstanding lateral and thermal stresses, and inward and outward loading pressures.

B. Install roof accessory items according to construction details of NRCA's "Roofing and Waterproofing Manual," unless otherwise indicated,

C. Separation: Separate metal from incompatible metal or corrosive substrates, including wood, by coating concealed surfaces, at locations of contact, with bituminous coating or providing other permanent separation.

D. Flange Seals: Unless otherwise indicated, set flanges of accessory units in a thick bed of roofing cement to form a seal.

E. Cap Flashing: Where required as component of accessory, install cap flashing to provide waterproof overlap with roofing or roof flashing (as counter-flashing). Seal overlap with thick bead of mastic sealant.

F. Operational Units: Test-operate units with operable components. Clean and lubricate joints and hardware. Adjust for proper operation.

3.2 CLEANING AND PROTECTION

A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings.

- END OF SECTION -

- SECTION 07 8413 -

PENETRATION FIRESTOPPING

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. Through-penetration firestopping in fire rated construction.
   2. Construction gap firestopping at connections of the same or different materials in fire rated construction.
   3. Construction-gap firestopping occurring within fire-rated wall, floor or floor-ceiling assemblies.

1.3 RELATED DOCUMENTS

A. Section 07 2100 “Thermal Insulation” for fire safing insulation.

B. Section 07 8446 “Fire-Resistive Joint Systems”.

1.4 REFERENCES

A. Underwriters Laboratories
   1. U.L. Fire Resistance Directory
      a. Through-Penetration Firestop Devices (XHCR)
      b. Fire Resistance Ratings (BXUV)
      c. Through-Penetration Firestop Systems (XHEZ)
      d. Fill, Void, or Cavity Material (XHHW)
      e. Forming Material (XHKU)
   2. U.L. 1479 Test Method for Fire Tests of Through-Penetration Firestops, including optional air leak test.
   3. U.L. Component Listing Test Criteria
   4. Warnock Hersey

B. American Society for Testing and Materials Standards:
   1. ASTM E 814-88: Standard Test Method for Fire Tests of Through-Penetration Firestops.
   2. ASTM E 1399-91: Standard Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems.

1.5 DEFINITIONS

A. Assembly: Particular arrangement of materials specific to given type of construction described or detailed in referenced documents.

B. Barriers: Time rated fire walls, smoke barrier walls, time rated ceiling/floor assemblies and structural floors.

C. Firestopping: Methods and materials applied in penetrations and unprotected openings to limit spread of heat, fire, gasses and smoke.

D. Penetration: Opening or foreign material passing through or into barrier or structural floor such that full thickness of rated materials is not obtained.

E. Construction gaps: Gaps between adjacent sections of walls, exterior walls, at wall tops between top of wall and ceiling, and structural floors or roof decks; and gaps between adjacent sections of structural floors.

F. System: Specific products and applications classified and numbered by Underwriters Laboratories, Inc. to close specific barrier penetrations.

G. Sleeve: Metal fabrication or pipe section extending through thickness of barrier and used to permanently guard penetration. Sleeves are described as part of penetrating system in other Sections and may or may not be required.

1.6 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.

B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with F ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.

C. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems with T ratings, in addition to F ratings, as determined per ASTM E 814, where indicated and where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas.

D. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per ASTM E 119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

E. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.

F. For firestopping exposed to view, provide products with flame-spread values of less than 25 and smoke-developed values of less than 450, as determined per ASTM E 84.

1.7 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of product specified.

1. Certification by firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.

C. Shop drawings detailing materials, installation methods, and relationships to adjoining construction for each through-penetration firestop system, and each kind of construction condition penetrated and kind of penetrating item. Include firestop design designation of qualified testing and inspecting agency evidencing compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop configuration for construction and penetrating items.

D. Product certificates signed by manufacturers of firestopping products certifying that their products comply with specified requirements.

E. Product test reports from, and based on tests performed by, a qualified testing and inspecting agency evidencing compliance of firestopping with requirements based on comprehensive testing of current products.

F. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

1.8 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide firestopping that complies with the following requirements and those specified under the "System Performance Requirements" article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems that is acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per ASTM E 814 under conditions where positive furnace pressure differential of at least 0.01 inch of water is maintained at a distance of 0.78 inch below the fill materials surrounding the penetrating items in the test assembly.
3. Fire-resistive joint sealant systems are identical to those tested for fire-response characteristics per ASTM E 119 under conditions where the positive furnace pressure differential is at least 0.01 inch of water, as measured 0.78 inch from the face exposed to furnace fire. Provide systems complying with the following requirements:

a. Fire-Resistance Ratings of Joint Sealants: As indicated by reference to design designations listed by UL in their "Fire Resistance Directory" or by another qualified testing and inspecting agency.
b. Joint sealants, including backing materials, bear classification marking of qualified testing and inspection agency.

B. Information on drawings referring to specific design designations of through-penetration firestop systems is intended to establish requirements for performance based on conditions that are expected to exist during installation. Any changes in conditions and designated systems require the Architect's prior approval. Submit documentation showing that the performance of proposed substitutions equals or exceeds that of the systems they would replace and are acceptable to authorities having jurisdiction.

C. Installer Qualifications: Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
1. Prior to installing fire stop assemblies, the installer shall furnish the Architect with written proof of qualification from the manufacturer of the fire stop material, certifying that the installer has satisfactorily completed technical and installation training for the specified products.
2. The manufacturer of the fire stop material shall, at no cost to the Owner or the Architect, provide sufficient inspections of installed systems to assure that all criteria required by the Project and by code are accomplished to the minimum standards shown in each UL system installed. The requirements of these Paragraphs 1.8.C.1 and 2 are in addition to any requirement and/or field inspection requirements requested by the local authority having jurisdiction.

D. Single-Source Responsibility: Obtain through-penetration firestop systems for each kind of penetration and construction condition indicated from a single manufacturer.

E. Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."

F. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver firestopping products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multi-component materials.

B. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.10 PROJECT CONDITIONS

A. Environmental Conditions: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilation: Ventilate firestopping per firestopping manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

1.11 SEQUENCING AND SCHEDULING

A. Notify Owner's inspection agency at least 1 week in advance of firestopping installations; confirm dates and times on days preceding each series of installations.

B. Do not cover up those firestopping installations that will become concealed behind other construction until Owner's inspection agency and authorities having jurisdiction, if required, have examined each installation.

PART 2 - PRODUCTS

2.1 FIRESTOPPING, GENERAL

A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials

B. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.

C. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" article in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems.

D. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.

2.2 FILL MATERIALS FOR THROUGH-PENETRATION FIRESTOP SYSTEMS

A. Products: Systems or devices listed in the U.L. Fire Resistance Directory under categories XHCR and XHEZ may be used, providing that the system or device conforms to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance, and that the system be symmetrical for wall applications. Systems or devices must be asbestos-free. Mortar systems must be Warnock Hersey approved.

1. Additional requirements: Withstand the passage of cold smoke either as an inherent property of the system, or by the use of a separate product included as a part of the U.L. system or device, and designed to perform this function.
2. Acceptable manufacturers and products: Those listed in the U.L. Fire Resistance Directory for the U.L. System involved, or Mortar systems approved by Warnock Hersey, and as shown on Drawings.
3. All firestopping products must be from a single manufacturer. All trades shall use products from the same manufacturer.

B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

G. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

H. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

I. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.

2.3 FIRE-RESISTIVE JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that complies with ASTM C 920 requirements, including those referenced for Type, Grade, Class, and Uses, and requirements specified in this Section applicable to fire-resistive joint sealants.

1. Sealant Colors: Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated. Where exposed to view, match color of adjacent surface.

B. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

C. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.

D. Acceptable Manufacturers and Products: Those listed in the U.L. Fire Resistance Directory for the U.L. System involved and as shown on Drawings.

2.4 ACCESSORIES

A. Fill, Void or Cavity Materials: As classified under Category XHHW in the U.L. Fire Resistance Directory.

B. Forming Materials: As classified under Category XHKU in the U.L. Fire Resistance Directory.

2.5 MIXING

A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:
   1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
   2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form release agents from concrete.

B. Priming: Prime substrates where recommended by firestopping manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.3 INSTALLING THROUGH-PENETRATION FIRESTOPS

A. General: Comply with the "System Performance Requirements" article in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:

1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 INSTALLING FIRE-RESISTIVE JOINT SEALANTS

A. General: Comply with the "System Performance Requirements" article in Part 1, with ASTM C 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.

C. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.

D. Tool nonsag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration indicated or required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.5 FIELD QUALITY CONTROL

A. Inspecting agency will examine completed firestopping to determine, in general, if it is being installed in compliance with requirements.

B. Inspecting agency will report observations promptly and in writing to Contractor and Project Inspector.

C. Do not proceed to enclose firestopping with other construction until reports of examinations are issued.

D. Where deficiencies are found, repair or replace firestopping so that it complies with requirements.

3.6 CLEANING

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.

B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they 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 firestopping immediately and install new materials to produce firestopping complying with specified requirements.

- END OF SECTION -

- SECTION 07 8446 -

FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes fire-resistive joint systems for the following:
   1. Floor-to-wall joints.
   2. Head-of-wall joints
   3. Joints between perimeter edge of fire-resistance-rated floor assemblies and back of non-fire-resistance-rated, exterior, insulated metal panel curtain wall system.

1.3 RELATED SECTIONS:

A. Section 07 2100 “Thermal Insulation” for perimeter fire-containment insulation systems if not specified in this Section.

B. Section 07 7129 "Manufactured Roof Expansion Joints" for fire-resistive roof expansion assemblies.

C. Section 07 8413 “Penetration Firestopping” for firestopping at non-joint conditions.

D. Section 07 9200 ”Joint Sealants” for non-fire-resistive joint sealants.

1.4 REFERENCES

A. Underwriters Laboratories, Inc. (UL) Fire Resistance Directory, Volume II, updated annually:
   1. Joint Systems (XHBN)
   2. Perimeter Fire Containment Systems (XHDG)
   3. Fire Resistance Ratings (BXRH)
   4. Fill, Voids, or Cavity Material (XHHW)
   5. Forming Materials (XHKU)

B. Omega Point Laboratories, Inc. (OPL) Listed Products Directory, Volume II, updated annually:
   1. Fire Resistant Joint Systems

C. ASTM E 1966, “Standard Test Method for Fire-Resistive Joint Systems”

D. ASTM E 1399, “Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Width of Architectural Joint Systems”

E. ASTM E 84, “Standard Test Method for Surface Burning Characteristics of Building Materials”

F. ASTM E 2174, “Standard Practice for On-Site Inspection of Installed Fire Stops”

G. ASTM E 2307, “Standard Test Method for Determining the Fire Endurance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus”

H. ANSI/UL 2079, “Tests for Fire Resistance of Building Joint Systems”

I. International Firestop Council Recommended (IFC) Guidelines for Evaluating Firestop Systems Engineering Judgments

J. All major building codes: ICBO, SBCCI, BOCA, and IBC.

K. NFPA 101 - Life Safety Code

1.5 PERFORMANCE REQUIREMENTS

A. General: For joints in the following constructions, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed:

1. Fire-resistance-rated non-load bearing wall, including partitions.
2. Fire-resistance-rated floor assemblies.
3. Exterior curtain-wall assemblies and fire-resistance-rated floor assemblies.

B. Fire Resistance of Joint Systems: Assembly ratings and movement capabilities indicated, but with assembly ratings not less than that equaling or exceeding fire-resistance rating of constructions in which joints are located, as determined by UL 2079.

C. Fire Resistance of Perimeter Fire-Containment Systems: Integrity and insulation ratings indicated as determined by NFPA 285 and UL 2079.

1.6 SUBMITTALS

A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of tested and listed firestop systems to be used and manufacturer's installation instructions to comply with Section 01 3219.

B. Manufacturer's engineering judgment identification number and drawing details when no tested and listed system is available for an application. Engineering judgment shall include both project name and contractor’s name who will install firestop system as described in drawing

C. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed and relationships to adjoining construction. Include fire-resistive joint

system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.

D. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.

E. Qualification Data: For Installer.

1. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer

F. Compatibility and Adhesion Test Reports: From fire-resistive joint system manufacturer indicating the following:

1. Materials forming joint substrates have been tested for compatibility and adhesion with fill materials.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

G. Submit material safety data sheets provided with product delivered to job-site

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."

1. For those firestop applications that exist for which no tested and listed system is available through a manufacturer, an engineering judgment derived from similar tested and listed system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings shall follow requirements set forth by the International Firestop Council.

B. Installation Responsibility: Assign installation of[through-penetration firestop systems and] fire-resistive joint systems in Project to a single qualified installer.

C. Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
2. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:
    a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.
    b. Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.9 PROJECT CONDITIONS

A. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings

B. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding

C. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

D. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

E. Do not use materials that contain flammable solvents.

F. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces

1.10 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until Owner's Project Inspector has examined each installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

1. Fire-Resistive Joint Systems:
   a. Hilti, Inc., Tulsa, Oklahoma (800) 879-8000/ www.us.hilti.com

2. Perimeter Fire-Containment Systems:
   a. Hilti, Inc., Tulsa, Oklahoma (800) 879-8000/ www.us.hilti.com.

2.2 MATERIALS

A. Use only firestop products that have been tested in accordance with ASTM E 1966 and/or ANSI/UL 2079 for specific rated construction conditions conforming to construction assembly type, movement capability, spacing requirements, and fire-resistance-rating involved for each separate instance.

B. Provide a firestop system with an Assembly Rating as determined by ASTM E 1966 and/or ANSI/UL 2079 which is equal to the fire-resistance ratings of the construction in which the joint occurs.
   1. Provide fire-safing insulation approved by manufacture. Refer to Section 07 2100 “Thermal Insulation” for more information.

2.3 FIRE-RESISTIVE JOINT SYSTEMS, GENERAL

A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.

B. Accessories: Provide components of fire-resistive joint systems, including forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

2.4 FIRE-RESISTIVE JOINT SYSTEMS

A. Where UL-classified fire-resistive joint systems are indicated, they refer to alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHBN.

B. Sealants for use with fire-resistance-rated construction joints, the following products are acceptable:
   1. Hilti CP 672 Speed Spray
   2. Hilti CP 601s Elastomeric Firestop Sealant
   3. Hilti CP 606 Flexible Firestop Sealant
   4. Hilti CP 604 Self-leveling Firestop Sealant

C. Floor-to-Wall, Fire-Resistive Joint System:
   1. Basis-of-Design UL-Classified Product: FW-D 1013.
   2. Assembly Rating: 1 hour or greater.
   3. Joint Width: As indicated on drawings.
   4. Movement Capabilities: Minimum of 40 percent compression, extension, or horizontal shear. Tested 500 cycle testing in accordance with ICBO ES AC and meets ASTM E 1966

D. Head-of-Wall, Fire-Resistive Joint System:
   1. Basis-of-Design UL-Classified Product: HW-D.

2. Assembly Rating: 1 hour or greater.
3. Nominal Joint Width: 3-inches.
4. Movement Capabilities: Minimum of 40 percent compression, or extension.

2.5 PERIMETER FIRE-CONTAINMENT SYSTEMS

A. Where UL-classified perimeter fire-containment systems are indicated, they refer to alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHDG.

B. Sealants for use as part of a Perimeter Fire Barrier System between fire-resistance-rated floors and exterior wall assemblies, the following products are acceptable:
1. Hilti CP 672 Speed Spray
2. Hilti CP 604 Self-leveling Firestop Sealant

C. Perimeter Fire-Containment System:
1. Basis-of-Design UL-Classified Product: CW-S-1007.
2. Integrity Rating: 2 hours.
3. Insulation Rating: 1/4 hour.
4. Linear Opening Width: 6 inches (152 mm), maximum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.

B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
2. Apply fill materials so they contact and adhere to substrates formed by joints.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified independent inspecting agency to inspect fire-resistive joint systems and to prepare inspection reports.

1. Project Inspector will state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.

B. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and inspecting agency has approved installed fire-resistive joint systems.

C. If deficiencies are found, repair or replace fire-resistive joint systems so they comply with requirements.

3.5 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

3.6 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Designation System for Joints in or between Fire-Resistance-Rated Constructions: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHBN.

B. Designation System for Joints at the Intersection of Fire-Resistance-Rated Floor or Floor/Ceiling Assembly and an Exterior Curtain-Wall Assembly: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHDG:

1. See drawings for specific assemblies required.

- END OF SECTION -

- SECTION 07 9200 -

JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section, and as noted in the schedule at the end of Part 3 of this section:

1. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
    a. Control and expansion joints on exposed interior surfaces of exterior walls.
    b. Perimeter joints of exterior openings where indicated.
    c. Tile control and expansion joints.
    d. Vertical joints on exposed surfaces of interior unit masonry walls and partitions.
    e. Perimeter joints between interior wall surfaces and frames of interior doors, windows.
    f. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    g. Control and expansion joints in ceilings and other overhead surfaces.
    h. Joints between different materials listed above.
    i. Other joints as indicated.
2. Interior joints in the following horizontal traffic surfaces:
    a. Isolation joints in cast-in-place concrete slabs.
    b. Control and expansion joints in stone flooring.
    c. Control and expansion joints in tile flooring.
    d. Other joints as indicated.

1.3 RELATED SECTIONS

A. Section 07 8413 "Penetration Firestopping" for sealing joints in fire-resistance-rated construction.

B. Section 07 8446 "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.

C. Section 07 9500 "Expansion Control" for building expansion joints.

D. Section 08 8000 "Glazing" for glazing sealants.

E. Section 09 2900 "Gypsum Board" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.

F. Section 09 3013 "Ceramic Tile" for sealing tile joints.

G. Section 09 5113 "Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.

H. Division 22 "Plumbing Fixtures" for sealing joints between fixtures and wall and floor surfaces.

I. Section 32 1373 “Concrete Paving Joint Sealants” for sealing joints in pavements, walkways, curbing, and building perimeter.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.

B. Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water resistant and cause no staining or deterioration of joint substrates.

1.5 SUBMITTALS

A. Product data and color chart from manufacturers for each joint sealant product required.
   1. Certification by joint sealant manufacturer that materials provided for this Section are 100% asbestos-free.

B. LEED Submittal:
   1. Product Data for Credit EQ 4.1: For sealants and sealant primers used inside the weatherproofing system, including printed statement of VOC content.

C. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.

1.6 QUALITY CONTROL

A. Sealants for Work of this Section shall be obtained from a single manufacturer for each different product required, to ensure that materials which come in contact with one another will be compatible. Installer shall supply a letter from the manufacturer certifying the compatibility of all sealants with one another, and with all construction materials with which they will come in contact on the Project.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.8 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
   2. When joint substrates are wet.

B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.9 SEQUENCING AND SCHEDULING

A. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

1.10 WARRANTY

A. Provide a warranty, in writing and signed jointly by the installer and sealant manufacturer, agreeing to replace any or all joints failing within the warranty period at not cost to the Owner, labor and material inclusive.
   1. Warranty: 3 years

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, joint fillers, 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. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Sealants: 250 g/L.

2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Colors: Provide color of exposed joint sealants to comply with the following:
1. Provide selections made by Architect from manufacturer's full range of colors for products of type indicated.

2.2 ELASTOMERIC JOINT SEALANTS, TYPICAL

A. Materials listed below are manufactured by Tremco, and establish the standard desired for this Project. Similar materials manufactured by the following are also acceptable:
1. Sonneborn
2. Sika Corp.
3. Pecora Corp.
4. Mameco.
5. Dow Corning.
6. General Electric.

B. Polyurethane sealants, multi-component. These sealants shall comply with ASTM C-920:
1. Sealant #1: Type M, Grade NS, Class 25, Use NT, M, A and O; capable of 50% extension and compression movement. (Dymeric 511)
2. Sealant #2: Type M, Grade P, Class 25, Use T, M, A and O. (THC - 900/901)

C. Silicone Sealants, one-part, complying with ASTM C-920:
1. Sealant #3: Type S, Grade NS, Class 25, Use NT, M, G, A and O; capable of 50% extension and compression movement. (Spectrem 2)
2. Sealant #4: Type S, Grade NS, Class 25, Use NT, M, G, A and O; capable of 100% extension and 50% compression movement. (Spectrem 1)
3. Sealant #5: Mildew-resistant, formulated with fungicide, Type S, Grade NS, Class 25, Use NT, A and O. (Tremsil 600) Color: White.

D. Sealant #6: Acrylic latex sealant, one-part, complying with ASTM C-834. (Acrylic Latex 834 Caulk)

E. Sealant #7: Acoustical sealant (ASTM D-217). (Tremco Acoustical Sealant)

2.3 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type 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.

B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.

a. Horizontal Application: ITP "HBR" or approved equal.
b. Vertical Application: ITP closed-cell or soft-type backer rod or approved equal.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 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, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

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. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:
1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
3. Remove laitance and form release agents from concrete.
4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

D. Remove sealant and prepare joints in existing exterior locations as directed by representative of sealant manufacturer specified in this work.

3.3 INSTALLATION OF TYPICAL JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
    a. Do not leave gaps between ends of joint fillers.
    b. Do not stretch, twist, puncture, or tear joint fillers.
    c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.

D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

E. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

1. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
2. Provide flush joint configuration, per Figure 5B in ASTM C 1193, where indicated.
    a. Use masking tape to protect adjacent surfaces of recessed tooled joints.
3. Provide recessed joint configuration, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:
   a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
   b. Perform 1 test for each 1000 feet (300 m) of joint length thereafter or 1 test per each floor per elevation.
2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
   a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
3. Inspect tested joints and report on the following:
   a. Whether sealants filled joint cavities and are free of voids.
   b. Whether sealant dimensions and configurations comply with specified requirements.
   c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

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

B. Clean excess adhesive from exposed surfaces of neoprene compression seal with solvent cleaner as recommended by manufacturer.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they 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 that and installations with repaired areas are indistinguishable from original work.

3.7 SCHEDULES, TYPICAL SEALANTS

A. Exterior Locations:
   1. Joints which are bordered by glass: Sealant #3.
   2. Joints which are bordered by plastic: Sealant #4.
   3. Horizontal joints in sidewalks, decks, concrete floors, and driveways: Sealant #2.
      a. At walk expansion joints.
      b. Where walks abut structural slabs or stoops.
      c. Where walks abut exterior wall of buildings.
      d. Where exposed interior concrete slabs abut vertical surfaces.
      e. Where sealant is shown on the Drawings for concrete slabs.
   4. All other exterior joints: Sealant #1.
      a. Around perimeters of frames where door, window and louver frames abut concrete, masonry or other building materials (interior and exterior).
      b. Expansion and control joints in masonry walls (interior and exterior).
      c. Masonry at dissimilar material or at dissimilar masonry.
      d. Sills and thresholds.
      e. At miscellaneous locations where sealant is shown on Drawings.

B. Interior Locations:
   1. Expansion and control joints: Sealant #1.
   2. Interior wet area and around plumbing fixtures: Sealant #5.
   3. Interior static dry joints as required to dress appearance: Sealant #6.
   4. Where required for sound control: Sealant #6 or #7.

C. General:
   1. Joints in construction between interior and exterior spaces and other designated or required locations to provide effective barrier against passage of elements: Sealant #1.
   2. Specialty perimeters where required for appearance or weather tightness: Sealants #1, #3 or #4.

- END OF SECTION -

- SECTION 07 9500 -

EXPANSION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Architectural joint systems for building interiors.
   2. Architectural joint systems for building exteriors.

1.3 RELATED SECTIONS

A. Section 03 3000 "Cast-in-Place Concrete" for cast-in architectural-joint-system frames furnished, but not installed, in this Section.

B. Section 07 6200 "Sheet Metal Flashing and Trim" for sheet metal wall joint systems.

C. Section 07 7129 "Manufactured Roof Expansion Joints" for factory-fabricated roof joint systems.

D. Section 07 8446 "Fire-Resistive Joint Systems" for liquid-applied joint sealants in fire-resistive building joints.

E. Section 07 9200 "Joint Sealants" for liquid-applied joint sealants.

F. Section 09 2900 “Gypsum Board”.

1.4 DEFINITIONS

A. Maximum Joint Width: Widest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.

B. Minimum Joint Width: Narrowest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.

C. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint opening typically expressed in numerical values (mm or inches) or a percentage (plus or minus) of nominal value of joint width.

D. Nominal Joint Width: The width of the linear opening specified in practice and in which the joint system is installed.

1.5 SUBMITTALS

A. Shop Drawings: Provide the following for each joint system specified:
   1. Placement Drawings: Include line diagrams showing plans, elevations, sections, details, splices, blockout requirement, entire route of each joint system, and attachments to other work. Where joint systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.
   2. Architectural Joint System Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
      a. Manufacturer and model number for each joint system.
      b. Joint system location cross-referenced to Drawings.
      c. Nominal joint width.
      d. Movement capability.
      e. Classification as thermal or seismic.
      f. Materials, colors, and finishes.
      g. Product options.
      h. Fire-resistance ratings.

B. Samples for Initial Selection: For each type of joint system indicated.
   1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.

C. Samples for Verification: For each type of architectural joint system indicated.
   1. Full width by 6 inches (150 mm) long, for each system required.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for current products.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain interior architectural joint systems through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of architectural joint systems and are based on the specific systems indicated. Refer to Division 1 Section "Product Requirements."

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

D. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines (ADAAG)".

E. Fire-Test-Response Characteristics: Where indicated, provide architectural joint system and fire-barrier assemblies identical to those of assemblies tested for fire resistance per UL 2079 or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction.

F. Hose Stream Test: Wall-to-wall and wall-to-ceiling assemblies shall be subjected to hose stream testing.

1.7 COORDINATION

A. Coordinate installation of exterior wall and soffit joint systems with roof expansion assemblies to ensure that wall transitions are watertight. Roof expansion assemblies are specified in Division 7.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 for extrusions; ASTM B 209 (ASTM B 209M), Alloy 6061-T6 for sheet and plate.

1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
2. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

B. Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames.

C. Compression Seals: ASTM E 1612; preformed rectangular elastomeric extrusions having internal baffle system and designed to function under compression.

D. Strip Seals: ASTM E 1783; preformed elastomeric membrane or tubular extrusions having an internal baffle system and secured in or over a joint by a metal locking rail.

E. Extruded Preformed Seals: Single or multi-layered rubber extrusions as classified under ASTM D2000, designed with or without continuous, longitudinal, internal baffles and formed to fit compatible frames, in color indicated or if not indicated, as selected by architect from manufacturer’s standard colors.

F. Exterior Seals: Typically two single layered flexible extrusions, one interior PVC and one exterior Santoprene 8000 series non-hydroscopic, thermoplastic rubber, as classified under ASTM D2000, retained in a set of compatible frames, in color indicated or if not indicated, as selected by architect from manufacturer’s standard colors.

G. Cellular Foam Seals: Extruded, compressible foam designed to function under compression.

H. Elastomeric Concrete: Modified epoxy or polyurethane extended into a prepackaged aggregate blend, specifically designed for bonding to concrete substrates.

I. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required rating period.

J. Moisture Barrier: Flexible elastomeric material,
   1. EPDM, minimum 45 mils thick.
   2. PVC , minimum 30 mils thick
   3. Santoprene

K. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.2 ARCHITECTURAL JOINT SYSTEMS, GENERAL

A. General: Provide architectural joint systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
   1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where joint changes direction or abuts other materials.
   2. Include factory-fabricated closure materials and transition pieces, tee-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous joint systems.

B. Design architectural joint systems for the following size and movement characteristics:
   1. Nominal Joint Width: As indicated.
   2. Movement Capability: Plus or minus 100 percent, unless otherwise noted.
   3. Type of Movement: Seismic.

2.3 FABRICATION

A. General – Provide expansion joint cover assemblies of design, basic profile, materials, and operation indicated. Select units comparable to those indicated or required to accommodate joint size, variations in adjacent surfaces, and structural movement. Furnish units in longest practicable lengths to minimize number of end joints. Provide hairline-mitered corners where joint changes directions or abuts other materials. Include closure materials and transition pieces., tee-joints, corners, curbs, cross-connections and other accessories as required to provide continuous joint cover assemblies.

2.4 ARCHITECTURAL JOINT SYSTEMS FOR BUILDING INTERIORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the products specified in individual subparagraphs below as basis-of-design products or a comparable product by one of the following:
   1. Balco, Inc.
   2. C/S Group.
   3. MM Systems Corporation.
   4. Nystrom, Inc.

B. Floor-to-Floor Joint Systems: (Carpet & Resilient Floor Coverings)

1. Basis-of-Design Product: Model SGR-1001 & SGR-1001S as manufactured by C/S Group, Muncy, PA tel: (570) 546-5941, web: www.c-sgroup.com.
2. Flush Seismic Cover Assemblies – Provide continuous extruded aluminum frame assemblies of a suitable profile to receive free floating cover plate of design indicated. Center plate to be held in place and kept centered throughout movement cycle by stainless steel turnbar spaced 24""on center maximum. Assembly (where indicated) to be sealed with dual durometer, colorable thermoplastic seals with rigid edges for positive attachment to frame and center plate. Free from grooves or ridges, seals to have flexible core of shore hardness 73 to allow maximum movement of 1 inch without gaps occurring between seal and cover assembly. Center plate to include concealed lifting device to allow full seismic movement without damage to cover. Seals to disengage under seismic conditions only. All aluminum in contact with concrete to have heavy metal free high solids primer.
   a. At VCT Floor Finishes – Provide continuous frame on each side of joint designed to support aluminum center plate recessed to receive floor finish inlay. Joint system to be capable of + and – 7" seismic movement. Model SGR-1001.
   b. At Other Floor Finishes - Provide continuous frame on each side of joint designed to support aluminum center plate. Aluminum center plate to receive factory-supplied stainless steel inlay with #4 finish. Joint system to be capable of + and – 7" seismic movement. Model SGR-1001S
3. Attachment Method: Cast in.
   a. Recess Depth: As required to accommodate adjacent flooring.
4. Load Capacity:
   a. Uniform Load: 150 lb/sq. ft. (732 kg/sq. m).
   b. Concentrated Load: 2000 lb (907 kg).
   c. Maximum Deflection: 0.5 inch (13 mm).
5. Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction.
6. Moisture Barrier: Manufacturer's standard.

C. Floor-to-Floor Joint Systems: (Stone Flooring)

1. Basis-of-Design Product: Model SGR-1001M as manufactured by C/S Group, Muncy, PA tel: (570) 546-5941, web: www.c-sgroup.com.
2. Extruded Aluminum Recessed Pan Seismic Cover Assemblies – Provide continuous extruded aluminum frame assemblies of suitable profile to receive free floating center plate of design indicated. Center plate to be held in place and kept centered throughout movement cycle by spring-loaded stainless steel turnbar spaced 18""on center maximum. Center plate to include concealed lifting device to allow full seismic movement without damage to cover. Cover to disengage under seismic conditions only. Cover shall be designed to achieve movement of ±1/2" thermal movement, + and – 7" horizontal movement during a seismic event. All aluminum in contact with concrete to have heavy metal free high solids primer.
   a. Concealed Stone Flush Floor Cover – Provide continuous frame on each side of joint, designed to support center pan and receive stone paver or concrete fill.
3. Attachment Method: Cast in.
   a. Recess Depth: As required to accommodate adjacent flooring.

4. Load Capacity:
   a. Uniform Load: 150 lb/sq. ft. (732 kg/sq. m).
   b. Concentrated Load: 2000 lb (907 kg).
   c. Maximum Deflection: 0.5 inch (13 mm).
5. Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction.
6. Moisture Barrier: Manufacturer's standard.

D. Wall-to-Wall & Ceiling to Ceiling Joint Systems:
1. Basis-of-Design Product: Model LAF-1000 as manufactured by C/S Group, Muncy, PA tel: (570) 546-5941, web: www.c-sgroup.com.
2. Lightweight Composite Seismic Cover Assemblies – Provide continuous extruded aluminum frame assemblies of suitable profile to receive free floating composite panel of design indicated. Panel shall be held in place with a hook and loop attachment system, spaced at a maximum 18” on center. A secondary support system comprised of pre-tensioned shock cords shall be installed directly behind the panel and attached with removable stainless steel spring clips.
   a. Flush Wall/Ceiling Cover – Provide continuous frame on each side of joint designed to support panel and finish flush with adjacent wall or ceiling surface. Cover to be of lightweight composite construction. Joint system to be capable of + and – 7” seismic movement. Panel shall be field primed and painted or covered with field-applied wall covering. As model LAF-1000.
3. Type: Free-Floating plate.
   a. Exposed Metal: Aluminum.
      1) Finish: Manufacturer's standard finish.
4. Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction.
5. Moisture Barrier: Manufacturer's standard.

E. Floor-to-Wall Joint Systems:
1. Basis-of-Design Product: C/S Group, Model Muncy, PA tel: (570) 546-5941, web: www.c-sgroup.com,
2. Type: Elastomeric seal.
   a. Exposed Metal: Aluminum.
      1) Finish: Manufacturer's standard finish.
   b. Seal Material: Santoprene.
      1) Color: As selected by Architect from manufacturer's full range.
3. Attachment Method: Cast in.
   a. Recess Depth: As required to accommodate adjacent flooring.
4. Load Capacity:
   a. Uniform Load: 150 lb/sq. ft. (732 kg/sq. m).
   b. Concentrated Load: 2000 lb (907 kg).
   c. Maximum Deflection: 0.5 inch (13 mm).
5. Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction.
6. Moisture Barrier: Manufacturer's standard.

F. Wall Corner Joint Systems:
1. Basis-of-Design Product: C/S Group, Model
2. Type: Glide plate.
a. Exposed Metal: Aluminum.
1) Finish: Manufacturer's standard finish.
3. Fire-Resistance Rating: Provide joint system and fire-barrier assembly with a rating not less than that of adjacent construction.
4. Moisture Barrier: Manufacturer's standard.

2.5 ARCHITECTURAL JOINT SYSTEMS FOR BUILDING EXTERIORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the products specified in individual subparagraphs below as basis-of-design products or a comparable product by one of the following:
1. Balco, Inc.
2. Construction Specialties, Inc.
3. JointMaster/InPro Corporation.
4. MM Systems Corporation.
5. Nystrom, Inc.
6. Tremco Sealant/Weatherproofing Division.

B. Architectural Joint Systems for Exterior Walls:
1. Basis-of-Design Products: Model SC-1000 as manufactured by C/S Group Muncy, PA tel: (570) 546-5941, web: www.c-sgroup.com.
2. Vertical Exterior Seals – Thermoplastic rubber primary seals extruded in Santoprene retained in extruded aluminum side frames complete with independent continuous PVC back seal. Side frames mounted on butyl caulk tape with appropriate anchor 18” on center. Installation to include factory, heat welded transitions where applicable to ensure a watertight system. System to include material for field-formed flexible base closures at base of vertical joints.
a. Supply primary seal with multi movement grooves designed to remain in place throughout movement of the joint.
b. Joint system to be capable of + and – 7” seismic movement.
3. Color of primary seal to be custom color selected by architect..

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where architectural joint systems will be installed for installation tolerances and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to architectural joint system manufacturer's written instructions.

B. Repair concrete slabs and blockouts using manufacturer's recommended repair grout of compressive strength adequate for anticipated structural loadings.

C. Coordinate and furnish anchorages, setting drawings, and instructions for installing joint systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

D. Cast-In Frames: Coordinate and furnish frames to be cast into concrete.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing architectural joint assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install joint systems.
   1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
   2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Architect where discrepancies occur that will affect proper joint installation and performance.
   3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
   4. Locate in continuous contact with adjacent surfaces.
   5. Heavy-Duty Systems: Repair or grout blockout as required for continuous frame support and to bring frame to proper level. Shimming is not allowed.
   6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches (75 mm) from each end and not more than 24 inches (600 mm) o.c.

C. Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
   1. Provide in continuous lengths for straight sections.
   2. Seal transitions according to manufacturer's written instructions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
   3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Compression Seals: Apply adhesive or lubricant adhesive as recommended by manufacturer to both frame interfaces before installing compression seals.

E. Foam Seals: Install with adhesive recommended by manufacturer.

F. Epoxy-Bonded Seals: Pressurize seal for time period and to pressure recommended by manufacturer. Do not over pressurize.

G. Terminate exposed ends of joint assemblies with field- or factory-fabricated termination devices.

H. Fire-Resistance-Rated Assemblies: Coordinate installation of architectural joint assembly materials and associated work so complete assemblies comply with assembly performance requirements.

1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

I. Water Barrier: Provide water barrier at exterior joints and where called for on Drawings. Provide drainage fittings at a maximum of 50 feet (15.2 m) or where indicated.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over joints. Reinstall cover plates or seals prior to Substantial Completion of the Work

- END OF SECTION -

DIVISION 08 – DOORS & WINDOWS

TABLE OF CONTENTS

- SECTION 08 1113 -

HOLLOW METAL DOORS & FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Steel doors.
   2. Steel door frames.
   3. Louvers in doors.
   4. Vision frames.
   5. Fire-rated door and frame assemblies.

B. Gasketing and hardware required for fire-rated door assemblies to comply with CBC 7-2 (2001) are specified in Section 08 7111 “Door Hardware”.

1.3 RELATED SECTIONS

A. Section 08 7111 “Door Hardware” for coordination of hardware installation.

B. Section 08 8000 “Glazing” for installation of glazing in hollow metal doors and farming systems, including STC sound rating.

C. Section 09 2900 “Gypsum Board” for coordination of installation.

D. Sections 09 9113 "Exterior Painting" and 09 9123 “Interior Painting” for field painting hollow metal doors and frames.

E. Section 13 4900 "Radiation Protection" for lead-lined, hollow metal doors and frames.

F. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators.

1.4 DEFINITIONS

A. Steel Sheet Thicknesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

1.5 REFERENCES

A. ANSI A250.8-1998/SDI-100 - Recommended Specifications - Standard Steel Doors and Frames, Steel Door Institute, unless herein specified.

B. Underwriters' Laboratories Inc. (UL) UL 10C-98 – Fire Tests of Door Assemblies.

C. NFPA-80-1999 – Standard for Fire Doors and Windows.

D. NFPA-101-1997 – Life Safety Code.

E. NFPA-105 – Standard for Smoke and Draft Control Assemblies.

F. ASTM-A 366-95A – Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.

G. ASTM-A 568-95 – Specification for Steel, Sheet, Carbon, and High Strength, Low-Alloy, Hot-Rolled, and Cold-Rolled.

H. ASTM-A 569-91a – Specification for Steel, Carbon, (0.15 maximum percent), Hot-Rolled Sheet and Strip Commercial Quality.

I. ASTM-A 924-95 – General Requirements for Steel Sheet, Metallic Coated by the Hot-Dip Process.

J. SDI-105-92 – Recommended Erection Instructions for Steel Frames.

K. ANSI A115.1-.18 - Specification for Door and Frame Preparation for Hardware.

L. ANSI A156.7 - Standard Template Hinge Dimensions.

1.6 SUBMITTALS

A. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.

B. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

C. Shop Drawings: Include the following:
   1. Elevations of each door design.
   2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.

5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

D. Oversize Construction Certificates: For door assemblies required to be fire-protection rated and exceeding size limitations of labeled assemblies.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.7 QUALITY ASSURANCE

A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.

B. Applicable Standards: Specifications and standards of SDI 100-98.

C. Wind Load Performance Requirements: Comply with wind load requirements of Uniform Building Code. Deflection shall not exceed 1/175 of span.

D. Supplier Qualification: Qualified direct distributor of products to be furnished. The distributor shall have in their regular employment an A.H.C. /C.D.C. or person of equivalent experience who will be available at reasonable times to consult with the Architect, Contractor and/or Owner regarding any matters affecting the total door and frame openings.

E. Installer Qualification: Experience with installation of similar materials.

F. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with NFPA 80 "Standard for Fire Doors and Windows", and have been tested, listed, and labeled in accordance with ASTM E152 "Standard Methods of Fire Tests of Door Assemblies" by nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.
   1. Oversize Fire-Rated Door Assemblies: For door assemblies required to be fire-rated and exceeding sizes of tested assemblies, provide certificate or label from approved independent testing and inspection agency, indicating that door and frame assembly conforms to requirements of design, materials and construction as established by individual listings for tested assemblies.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.

C. Store doors and frames at building site under cover. Place units on minimum 4-inch-wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch between stacked doors to permit air circulation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hot-Rolled Steel Sheets: ASTM A 569, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

B. Cold-Rolled Steel Sheets: ASTM A 366, Commercial Steel (CS), or ASTM A 620, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.

C. Metallic-Coated Steel Sheets: ASTM A 653, Commercial Steel (CS), Type B, with an A40 (galvannealed) coating; stretcher-leveled standard of flatness.

1. For exterior installations.

D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.

2.2 ACCEPTABLE MANUFACTURERS

A. Providing the products supplied comply with specifications.

1. CURRIES Co., Mason City, Iowa
2. Ceco Door Products, headquartered Milan, Tennessee
3. Door Components, Inc.
4. Steelcraft. Ingersol Rand manufacturers

1. **DOORS**

A. General: Provide doors of sizes, thicknesses, and designs indicated.

B. Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless) (0.053-inch / 16 ga. thick).

C. Exterior Doors: 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 2 (Seamless) (0.053-inch / 16 ga. thick).

D. Door Louvers: Provide louvers for doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch- (24 ga.) thick, cold-rolled steel sheet set into 0.032-inch- (20 ga.) thick steel frame.

1. Sightproof Louvers: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.

E. Vision Lite Systems: Manufacturer's standard kits for metal doors consisting of glass lite moldings to accommodate glass thickness and size of vision lite indicated.

2.4 FRAMES

A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

B. Frames of 0.067-inch- (14 ga.) thick steel sheet for:

1. Level 3 steel doors, unless otherwise indicated.
2. Wood doors, unless otherwise indicated.

C. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.

D. Plaster Guards: Provide 0.020-inch- (24 ga.) thick, steel sheet plaster guards or mortar boxes to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.

E. Supports and Anchors: Fabricated from not less than 0.042-inch- (18 ga.) thick, electrolytic zinc-coated or metallic-coated steel sheet.

1. Wall Anchors in Masonry Construction: 0.177-inch-diameter, steel wire complying with ASTM A 510 may be used in place of steel sheet.

F. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153, Class C or D as applicable.

G. Coating Materials, primer: Use manufacturer’s standard rust inhibiting primer conforming to ANSI-A224.1-1990.

2.5 FABRICATION

A. General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.

B. Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch- (16 ga.) thick, metallic-coated steel channels with channel webs placed even with top and bottom edges.

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
   1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
   1. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Core Construction: Manufacturer's standard core construction that produces a door complying with SDI standards.

G. Single-Acting, Door-Edge Profile: Square edge, unless beveled edge is indicated.

H. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

I. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.

J. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

K. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.

L. Frame Construction: Fabricate frames to shape shown.
   1. Fabricate frames with mitered and continuously welded corners and seamless face joints (knock-down frames not acceptable).
   2. Fabricate all exterior door frames with integral metal drip.

M. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

N. Glazing Stops: Manufacturer's standard, formed from 0.032-inch-thick (20 ga.) steel sheet.
   1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
   2. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors, using vandal-resistant screws.

2.6 FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.EXECUTION

2.7 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch (1.6 mm), 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.

2.8 INSTALLATION

A. General: Install steel doors, frames, and accessories according to ANSI A250.8, manufacturer's data, and as specified.

B. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

1. Place frames before construction of enclosing walls and ceilings.
2. In masonry construction, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
3. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces
4. In metal-stud partitions, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.
5. Install fire-rated frames according to NFPA 80.

6. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.
   1. Fire-Rated Doors: Install within clearances specified in NFPA 80.

D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
   1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

2.9 ADJUSTING AND CLEANING

A. Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.

B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

C. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

- END OF SECTION -

- SECTION 08 1216 -

INTERIOR ALUMINUM FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Interior aluminum framing.
   2. Interior aluminum frames for doors.
   3. Interior aluminum frames for glazing.

1.3 RELATED SECTIONS

A. Section 07 9200 "Joint Sealants" for joint sealants installed with interior aluminum frames and for sealants to the extent not specified in this Section.

B. Section 08 1416 "Flush Wood Doors" for wood doors installed in interior aluminum frames.

C. Section 08 3113 “Flush Fiberglass Doors” for fiberglass doors installed in interior aluminum frames.

D. Section 08 7111 "Door Hardware" for door hardware.

E. Section 08 8000 "Glazing" for glass in interior aluminum frames.

F. Section 09 2900 "Gypsum Board" for partitions.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of interior aluminum frame indicated.

B. Shop Drawings: For interior aluminum frames. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: 12-inch- (300-mm-) long framing member with factory-applied finish for each type of interior aluminum frame indicated. Color as indicated within this section.

D. Fabrication Sample: For each vertical-to-horizontal intersection of systems, made from 12-inch (300-mm) lengths of full-size components and showing details of assembly.

E. Maintenance Data: For interior aluminum frames to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of interior aluminum frames and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Custom Components Company.
2. Dual Lock Partition Systems, Inc.
3. Frameworks Manufacturing.
4. Modulex, Inc.
5. RACO Interior Products, Inc.
6. Versatrac.
7. Western Integrated Materials, Inc.**
8. Wilson Partitions.

2.2 COMPONENTS

A. Aluminum Framing, General: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 or alloy and temper required to suit structural and finish requirements, not less than 0.062 inch (1.6 mm) thick.

B. Door Frames: Reinforced for hinges and strikes.

C. Glazing Frames: For glazing thickness indicated.

D. Ceiling Tracks: Extruded aluminum.

E. Trim: Extruded aluminum, not less than 0.062 inch (1.6 mm) thick, with removable snap-in casing trim without exposed fasteners.

2.3 ACCESSORIES

A. Fasteners: Aluminum, nonmagnetic stainless-steel or other noncorrosive metal fasteners compatible with frames, stops, panels, reinforcement plates, hardware, anchors, and other items being fastened.

B. Sound Seals: Manufacturer's standard continuous mohair, wool pile, or vinyl seals.

C. Smoke Seals: Intumescent strip or fire-rated gaskets.

D. Glazing Gaskets: Manufacturer's standard extruded or molded plastic, to accommodate glazing thickness indicated.

E. Glazing: Comply with requirements in Division 8 Section "Glazing."

F. Hardware: Comply with requirements in Division 8 door hardware Sections.

2.4 FABRICATION

A. Machine jambs and prepare for hardware, with concealed reinforcement plates, drilled and tapped as required, and fastened within frame with concealed screws.

B. Provide concealed corner reinforcements and alignment clips for accurately fitted hairline joints at butted or mitered connections.

C. Fabricate frames for glazing with removable stops to allow glazing replacement without dismantling frame.

D. Fabricate all components to allow secure installation without exposed fasteners.

2.5 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

1. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 1.0 mils (0.025 mm), medium gloss.
2. Color: Match Architect's sample.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and ceilings, with Installer present, for conditions affecting performance of work.
   1. Verify that wall thickness does not exceed standard tolerances allowed by throat size indicated.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with frame manufacturer's written installation instructions.

B. Install frames plumb and square, securely anchored to substrates.

C. Install frame components in the longest possible lengths; components up to 72 inches (1830 mm) long must be 1 piece.
   1. Fasten to suspended ceiling grid on maximum 48-inch (1220-mm) centers, using sheet metal screws or other fasteners approved by frame manufacturer.
   2. Use concealed installation clips to produce tightly fitted and aligned splices and connections.
   3. Secure clips to main structural extrusion components and not to snap-in or trim members.
   4. Do not leave screws or other fasteners exposed to view when installation is complete.

3.3 CLEANING

A. Clean exposed frame surfaces promptly after installation, using cleaning methods recommended by frame manufacturer and according to AAMA 609 & 610.

B. Touch up marred frame surfaces so touchup is not visible from a distance of 24 inches (610 mm). Remove and replace frames with damaged finish that cannot be satisfactorily repaired.

- END OF SECTION -

- SECTION 08 1416 -

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Solid-core doors with wood-veneer faces.
   2. Factory finishing flush wood doors.
   3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.3 RELATED SECTIONS

A. Section 08 1113 “Hollow Metal Doors & Frames” for installation in metal frames as scheduled, or required by acoustics and fire rating.

B. Section 08 7111 “Door Hardware” for coordination of hardware installation.

C. Section 09 2900 “Gypsum Board” for coordination of installation.

D. Sections 09 9113 “Exterior Painting” and 09 9123 “Interior Painting” for sealing bottom edged of doors due to field undercut of new or existing doors.

1.4 SUBMITTALS

A. Product Data: For each type of door, including details of core and edge construction, trim for openings, and factory-finishing specifications.

B. LEED Submittals:
   1. Certificates for Credit MR 7: Chain-of-custody certificates certifying that flush wood doors comply with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
      a. Include statement indicating costs for each certified wood product.
   2. Product Data for Credit EQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.

C. Shop Drawings: Indicate location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements for veneer matching and factory finishing and other pertinent data.
   1. For factory-machined doors, indicate dimensions and locations of cutouts for locksets and other cutouts adjacent to light openings.

D. Samples for verification in the form and size indicated below:
   1. Finish sample with same materials proposed for factory-finished doors to match Architects Sample.

1.5 QUALITY ASSURANCE

A. Fire-Rated Wood Doors: Provide wood doors which are identical in materials and construction to units tested in door and frame assemblies in accordance NFPA 252 and which are labeled and listed for ratings indicated by ITS – Warnock Hersey, UL or other testing and inspection agency acceptable to authorities having jurisdiction.
   1. Doors: Comply with UBC 7-2 1997 where required.
   2. Provide intumescent requirements in compliance with UL-10C.

B. WDMA I.S. 1-A 1997 Quality Standard: Window and Door Manufacturers Association Quality Standards for grade of door, core, construction, finish, and other requirements.

C. Quality Inspection: Provide one additional extra heavy duty, heavy duty, standard duty and hollow core door for inspection purposes. The architect will chose one door, of each type, at random, to “Tear Down” and inspect for door construction compliance with the project specification (veneer thickness, core material, stile & rail size & material, blocking, etc.). These doors shall be included in the wood door supplier’s base price on the date that the project bids.

D. Forest Certification: Provide doors made with veneers obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

E. Provide core with option of acquiring LEED credit towards one of the following categories:
   1. MR 4.1 and 4.2 - Recycled Material
   2. MR 5.1 - Regional Materials (Manufactured within 500 miles jobsite)
   3. MR 6.0 – Rapidly Renewable
   4. EQ 4.4 – Low Emitting Materials

F. Temperature Rise Rating: At stairwell enclosures, provide doors which have Temperature Rise Rating of 250 degrees F maximum in 30 minutes of fire exposure.

G. Single-Source Responsibility: Obtain doors from one source and by a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's instructions.

B. Identify each door with individual opening numbers as designated on shop drawings, using temporary, removable, or concealed markings.

1.7 PROJECT CONDITIONS

A. Conditioning: Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during the remainder of the construction period to comply with the following requirements applicable to Project's geographical location:

1. AWI Quality Standard Section 100-S-11 "Relative Humidity and Moisture Content."

1.8 WARRANTY

A. General Warranty: Warranties shall be in addition to, and not a limitation of, other rights the Owner may have under requirements of the Contract Documents.

B. Door Manufacturer's Warranty: Submit written agreement on door manufacturer's standard form signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section or that show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span, or do not conform to tolerance limitations of referenced quality standards.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors where defect was not apparent prior to hanging.
2. Warranty shall be in effect during the following period of time after date of Substantial Completion.
   a. Solid Core Interior Doors: Life of installation.

C. Contractor's Responsibilities: Replace and refinish doors where Contractor's work contributed to rejection or to voiding of manufacturer's warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

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

1. Graham Manufacturing
2. Eggers Industries
3. Algoma Hardwoods
4. VT Industries
5. Marshfield Doors

2.2 DOOR CONSTRUCTION, GENERAL

A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

B. WDMA I.S.1-A Performance Grade:
   1. Heavy Duty unless otherwise indicated.
   2. Extra Heavy Duty: Classrooms, public toilets, janitor's closets, assembly spaces and exits.

2.3 FLUSH WOOD DOOR MATERIALS

A. Non-Fire Rated Doors: Thickness: 1-3/4 inches, interior flush wood, bonded, solid core conforming to WDMA I.S. 1-A 1997 and the following;
   1. Adhesives: Do not use adhesives containing urea formaldehyde.
   2. Core: Bonded structural composite lumber (SCL-5 Timberstrand LSL) conforming to WDMA I.S. 1-A 1997.
   3. Door construction shall conform to WDMA I.S. 1-A 1997 Premium Grade A requirements.
   4. Stiles: Hardwood to match face veneer over structural composite lumber (SCL), glued to core.
   5. Rails: Mill option hardwood or SCL. Top and bottom: 2 inches.
   6. Facing: Wood veneer as specified.
   7. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.

B. Fire Rated Doors: Thickness: 1-3/4 inches, interior flush wood, bonded, solid core conforming to WDMA I.S. 1-A 1997 and the following;
   1. Adhesives: Do not use adhesives containing urea formaldehyde.
   2. Core: bonded mineral core (FD) conforming to WDMA I.S. 1-A 1997.
   3. Door construction shall conform to WDMA I.S. 1-A 1997 Premium Grade requirements.
   4. Stiles: Hardwood to match face veneer over mineral composite, glued to core.
   5. Rails: Mineral composite as required by fire door authorities. Top and bottom: as required by manufacturer’s fire door authorities.
   6. Facing: Wood veneer as specified.
   7. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.
   8. Where UBC 7-2-1997 requirements for positive pressure must be met, doors shall include all requirements as part of the door construction per 'Category A' guidelines as published by ITS/Warnock-Hersey. No intumescent is allowed on the frame. Only smoke gasketing applied around the perimeter of the frame to meet the 'S' smoke rating is permissible in instances where smoke control is required.

C. WOOD VENEER
   1. Door face veneers shall meet HPVA Premium “A” grade quality standards conforming to WDMA I.S. 1-A for transparent or semi-transparent finish. Minimum face veneer thickness shall be 1/50” at 12% moisture content after finish sanding.
   2. Species: As selected by Architect.
   3. Face Cut: As selected by Architect.
   4. Face Assembly: Book Match
   5. Face Symmetry: Center Balanced Match.
   6. Pairs, Sets &Transoms: Matched

D. ANSI / WDMA I.S. 1-A Performance Duty Level: Extra Heavy Duty per WDMA Standards.

Performance Attributes Table	EXTRA HEAVY DUTY	HEAVY DUTY	STANDARD DUTY
Adhesive Bond Durability WDMA TM-6	Type II	Type II	Type II
Cycle Slam WDMA TM-7	1,000,000 Cycles	500,000 Cycles	250,000 Cycles
Hinge Loading WDMA TM-8	550 lbs.	475 lbs.	400 lbs.
Door Finishes Various ASTM test methods	TR-6/OP-6	TR-4/OP-4	TR-2/OP-2
Screwholding WDMA TM-10			
Door Face (unblocked)	550 lbs.	475 lbs.	400 lbs.
Door Face (optional blocking)	700 lbs.	700 lbs.	700 lbs.
Vertical Door Edge	500 lbs.	475 lbs.	400 lbs.
Horizontal Door Edge	300 lbs.	240 lbs.	180 lbs.
Telegraph WDMA T-1	Maximum 0.010in. Per 3 in. span		
Warp Tolerance WDMA T-2	Maximum 0.25 in. per 3'-6" x 7'-0" door section		
Squareness WDMA T-3	Diagonal Variance 0.125 in.		

E. ADHESIVES
1. Adhesives:
   a. Do not use adhesives containing urea formaldehyde.
   b. Face to core adhesives shall be Type I or Type II as appropriate for location in building. Adhesives must be classified Type I or Type II per WDMA TM-6 “Adhesive Bond Test Method.” Type I adhesives shall be used for doors in exterior applications, Type II adhesives shall be used for doors in interior applications.

F. CORE
1. Non-rated and 20 minute doors: Solid particleboard.
2. Fire-rated doors: Non-combustible mineral core containing no asbestos.

G. FACTORY FINISHING
1. Comply with referenced WDMA Section G-15, “Factory Finishing.”.
2. Pre-finish wood doors at factory.
3. Transparent Finish: Match finish indicated in WDMA Section G-17: WDMA System #6.

H. STC Requirements: See Door Schedule Sheet in Drawings.

2.4 ACCESSORIES

A. Vision Frames:
1. Non-rated doors: Flush wood frames, hardwood to match facing.
2. 20 minute fire rated doors: Provide manufacturer's tested metal clip or comparable system with wood stop appearance.
3. Fire-rated doors: ITS – Warnock Hersey or UL approved glazing system.

4. Glass: Refer to Section 08 8000 for glass types.

2.5 FABRICATION

A. Fabricate wood doors in accordance with requirements of WDMA I.S. 1-A 1997 Quality Standards.

B. Fabricate fire rated doors in accordance with requirements of ITS – Warnock Hersey or Underwriters' Laboratories, with metal label on each door including UL-10C.

C. Fabricate doors with WDMA Quality Standards hardware blocking options as follows:
   1. Provide HB-1 – head and HB-2 – sill rails and HB-4 – lock block on all doors.
   2. Provide HB-6 only when exit devices are specified for door.
   3. Provide HB-8 for pivots or when floor bolts are specified under Section 08 7111 – Door Hardware.

D. Provide doors with minimum ¼ inch thick edge strips, of wood species to match face veneers except as required for fire rating.

E. Make cut-outs and provide stops for glass and louvers. Install metal door louvers. Seal cut-outs prior to installation of moldings.
   1. For full light doors: Provide cut out from flush wood door, with vertical grain direction.

F. Bevel lock and hinge edges of single acting doors 3 degrees or 1/8 inch in 2 inches. Radius strike edge of double acting swing doors as required by pivot hinge manufacturer.

G. Prepare doors to receive hardware. Refer to Section 08 7111 “Door Hardware” and NFPA 80 for hardware requirements including UL-10C.
   1. Prefit and bevel to net opening size less approximately 1/4 inch in width on single swing doors 3/16 inch in width for paired doors. Provide 1/4 inch clearance above finished floor, unless otherwise indicated on drawings. Provide 1/8 inch clearance at top of door.
   2. Slightly ease vertical edges.

H. Fire Rated Pair of Doors; greater than 20 minute: Supply overlapping astragals or metal edge sets only as required by NFPA 80 1999 or by door manufacturer’s fire door authorities. If an astragal is required, to comply with fire rated labeling requirements for pairs of fire rated doors, provide door manufacturer's standard tested astragal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine installed door frames before hanging doors.

B. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Handle doors in accordance with recommendations of WDMA I.S. 1-A, “Care and Installation at Job Site.”

B. Condition doors to average temperature and humidity in area of installation for not less than 48 hours prior to installation. Store doors per recommendations of WDMA I.S. 1-A, “Care and Installation at Job Site.”

C. Install in neat and workmanlike manner, free from hammer or tool marks, open joints or slivers.

D. Set plumb, level, square and true. Install work after building humidity is at acceptable level.

E. Remove and replace all doors found to be warped, twisted, bowed, or otherwise damaged. Do not install doors which cannot be properly fitted to frames.

F. Adjust prefinished doors and hardware and other moving or operating parts to function smoothly and correctly.

G. If doors are to be field finished, the process must follow the WDMA I.S. 1-A, “Care and Handling at Job Site” instructions for field applied finishes.

H. Ensure that smoke gaskets are in-place before prefinished door installation.

3.3 ADJUSTING AND PROTECTION

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Refinish or replace doors damaged during installation.

C. Protect doors as recommended by door manufacturer to ensure that wood doors will be without damage or deterioration at the time of Substantial Completion.

- END OF SECTION -

- SECTION 08 1613 -

FRP FLUSH DOORS

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. Fiberglass reinforced polyester (FRP) flush doors.

B. Fire Rated Fiberglass reinforced polyester (FRP) flush doors.

1.3 RELATED SECTIONS

A. Section 08 1113 “Hollow Metal Doors and Frames” for installation in metal frames as scheduled, or required by acoustics and fire rating.

B. Section 08 7111 “Door Hardware” for coordination of hardware installation.

C. Section 09 2900 “Gypsum Board” for coordination of installation.

1.4 REFERENCES

A. AAMA 1503-98 - Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.

B. ANSI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings.

C. ASTM B 117 - Operating Salt Spray (Fog) Apparatus.

D. ASTM B 209 - Aluminum and Aluminum-Alloy Sheet and Plate.

E. ASTM B 221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

F. ASTM D 256 - Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.

G. ASTM D 543 - Evaluating the Resistance of Plastics to Chemical Reagents.

H. ASTM D 570 - Water Absorption of Plastics.

I. ASTM D 638 - Tensile Properties of Plastics.

J. ASTM D 790 - Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

K. ASTM D 1308 - Effect of Household Chemicals on Clear and Pigmented Organic Finishes.

L. ASTM D 1621 - Compressive Properties of Rigid Cellular Plastics.

M. ASTM D 1623 - Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.

N. ASTM D 2126 - Response of Rigid Cellular Plastics to Thermal and Humid Aging.

O. ASTM D 2583 - Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

P. ASTM D 5420 – Impact Resistance of Flat Rigid Plastic Specimens by Means of a Falling Weight.

Q. ASTM D 6670-01 - Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/Products.

R. ASTM E 84 - Surface Burning Characteristics of Building Materials.

S. ASTM E 90 - Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

T. ASTM E 283 - Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

U. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

V. ASTM E 331 - Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

W. ASTM F 476 - Security of Swinging Door Assemblies.

X. NWWDA T.M. 7-90 – Cycle Slam Test Method

Y. SFBC PA 201 - Impact Test Procedures.

Z. SFBC PA 203 - Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.

AA. SFBC 3603.2 (b) (5) - Forced Entry Resistance Test.

1.5 PERFORMANCE REQUIREMENTS

A. General: Provide door assemblies that have been designed and fabricated to comply with specified performance requirements, as demonstrated by testing manufacturer's corresponding standard systems.

B. Air Infiltration: For a single door 3'-0" x 7'-0", test specimen shall be tested in accordance with ASTM E 283 at pressure differential of 6.24 psf. Door shall not exceed 0.90 cfm per linear foot of perimeter crack.

C. Water Resistance: For a single door 3'-0" x 7'-0", test specimen shall be tested in accordance with ASTM E 331 at pressure differential of 7.50 psf. Door shall not have water leakage.

D. Indoor air quality testing per ASTM D 6670-01: GREENGUARD Environmental Institute Certified including GREENGUARD for Children and Schools Certification.

E. Hurricane Test Standards, Single Door with Single-Point Latching:
   1. Uniform Static Load, ASTM E 330: Plus or minus 75 pounds per square foot.
   2. Forced Entry Test, 300 Pound Load Applied, SFBC 3603.2 (b) (5): Passed.
   3. Cyclic Load Test, SFBC PA 203: Plus or minus 53 pounds per square foot.
   4. Large Missile Impact Test, SFBC PA 201: Passed.

F. Swinging Door Cycle Test, Doors and Frames, ANSI A250.4: Minimum of 25,000,000 cycles.

G. Cycle Slam Test Method, NWWDA T.M. 7-90: Minimum 5,000,000 Cycles.

H. Swinging Security Door Assembly, Doors and Frames, ASTM F 476: Grade 40.

I. Salt Spray, Exterior Doors and Frames, ASTM B 117: Minimum of 500 hours.

J. Sound Transmission, Exterior Doors, STC, ASTM E 90: Minimum of 25.

K. Thermal Transmission, Exterior Doors, U-Value, AAMA 1503-98: Maximum of 0.29 BTU/hr x sf x degrees F. Minimum of 55 CRF value.

L. Surface Burning Characteristics, FRP Doors and Panels, ASTM E 84:
   1. Flame Spread: Maximum of 200, Class C.
   2. Smoke Developed: Maximum of 450, Class C.

M. Surface Burning Characteristics, Class A Option On Interior Faces of FRP Exterior Panels and Both Faces of FRP Interior Panels, ASTM E 84:
   1. Flame Spread: Maximum of 25.
   2. Smoke Developed: Maximum of 450.

N. Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D 256: 15.0 foot-pounds per inch of notch.

O. Tensile Strength, FRP Doors and Panels, Nominal Value, ASTM D 638: 14,000 psi.

P. Flexural Strength, FRP Doors and Panels, Nominal Value, ASTM D 790: 21,000 psi.

Q. Water Absorption, FRP Doors and Panels, Nominal Value, ASTM D 570: 0.20 percent after 24 hours.

R. Indentation Hardness, FRP Doors and Panels, Nominal Value, ASTM D 2583: 55.

S. Gardner Impact Strength, FRP Doors and Panels, Nominal Value, ASTM D 5420: 120 in-lb.

T. Abrasion Resistance, Face Sheet, Taber Abrasion Test, 25 Cycles at 1,000 Gram Weight with CS-17 Wheel: Maximum of 0.029 average weight loss percentage.

U. Stain Resistance, ASTM D 1308: Face sheet unaffected after exposure to red cabbage, tea, and tomato acid. Stain removed easily with mild abrasive or FRP cleaner when exposed to crayon and crankcase oil.

V. Chemical Resistance, ASTM D 543. Excellent rating.
1. Acetic acid, Concentrated.
2. Ammonium Hydroxide, Concentrated.
3. Citric Acid, 10%.
4. Formaldehyde.
5. Hydrochloric Acid, 10%
6. Sodium hypochlorite, 4 to 6 percent solution.

W. Compressive Strength, Foam Core, Nominal Value, ASTM D 1621: 79.9 psi.

X. Compressive Modulus, Foam Core, Nominal Value, ASTM D 1621: 370 psi.

Y. Tensile Adhesion, Foam Core, Nominal Value, ASTM D 1623: 45.3 psi.

Z. Thermal and Humid Aging, Foam Core, Nominal Value, 158 Degrees F and 100 Percent Humidity for 14 Days, ASTM D 2126: Minus 5.14 percent volume change.

1.6 SUBMITTALS

A. Comply with Section 01 3219 - Submittal Procedures.

B. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes, and installation.

C. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details, indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule, and finish.

D. Samples:
1. Door: Submit manufacturer's sample of door showing face sheets, core, framing, and finish.
2. Color: Submit manufacturer's samples of standard colors of doors and frames.

E. Test Reports: Submit certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.

F. Manufacturer's Project References: Submit list of successfully completed projects including project name and location, name of architect, and type and quantity of doors manufactured.

G. Maintenance Manual: Submit manufacturer's maintenance and cleaning instructions for doors, including maintenance and operating instructions for hardware.

H. Warranty: Submit manufacturer's standard warranty.

1.7 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years successful experience.
   2. Door and frame components from same manufacturer.
   3. Evidence of a compliant documented quality management system.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying opening door mark and manufacturer.

B. Storage: Store materials in clean, dry area indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials and finish from damage during handling and installation.

1.9 WARRANTY

A. Warrant doors, frames, and factory hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.

B. Warranty Period: Ten years starting on date of shipment. In addition, a limited lifetime (while the door is in its specified application in its original installation) warranty covering failure of corner joinery, core deterioration, delamination or bubbling of door skin.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Special-Lite, Inc., PO Box 6, Decatur, Michigan 49045. Tel: (800) 821-6531. Fax (800) 423-7610, www.special-lite.com.

2.2 FRP FLUSH DOORS

A. Model: SL-17 Flush Doors with SpecLite3 fiberglass reinforced polyester (FRP) face sheets.

B. Door Opening Size: As indicated on the Drawings.

C. Construction:
   1. Door Thickness: 1-3/4 inches.
   2. Stiles and Rails: Aluminum Alloy 6063-T5, minimum of 2-5/16-inch depth.
   3. Corners: Mitered.

4. Provide joinery of 3/8-inch diameter full-width tie rods through extruded splines top and bottom as standard tubular shaped stiles and rails reinforced to accept hardware as specified.
5. Securing Internal Door Extrusions: 3/16-inch angle blocks and locking hex nuts for joinery. Welds, glue, or other methods are not acceptable.
6. Furnish extruded stiles and rails with integral reglets to accept face sheets. Lock face sheets into place to permit flush appearance.
7. Rail caps or other face sheet capture methods are not acceptable.
8. Extrude top and bottom rail legs for interlocking continuous weather bar.
9. Meeting Stiles: Pile brush weatherseals. Extrude meeting stile to include integral pocket to accept pile brush weatherseals.
10. Bottom of Door: Install bottom weather bar with nylon brush weatherstripping into extruded interlocking edge of bottom rail.
11. Glue: Use of glue to bond sheet to core or extrusions is not acceptable.

D. Face Sheet:
1. Material: SpecLite3 FRP, 0.120-inch thickness, finish color throughout.
2. Protective coating: Abuse-resistant engineered surface.
3. Texture: Pebble.
4. Colors: As selected by Architect.
5. Adhesion: The use of glue to bond face sheet to foam core is prohibited.

E. Core:
1. Material: Poured-in-place polyurethane foam.
2. Density: Minimum of 5 pounds per cubic foot.
3. R-Value: Minimum of 9.

F. Cutouts:
1. Manufacture doors with cutouts for required vision lites, louvers and panels.
2. Factory install vision lites, louvers and panels.

G. Hardware:
1. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.
2. SL-11HD continuous hinges
3. Factory install hinges, locksets and panic hardware.

2.3 FRP CLAD FIRE-RATED DOORS

A. Model: SL-21 fire rated doors with SpecLite3 fiberglass reinforced polyester (FRP) face sheets.

B. 90-Minute Full-Scale Vertical Fire Test of Doors, Positive Pressure: Comply with acceptance criteria for 90-minute rating.
1. UBC Standard 7-2.
2. NFPA 252.
3. UL 10C.

C. Door Opening Size: As indicated on the Drawings.

D. Construction:
1. Door Thickness: 1-7/8 inches at door edge..
2. Stiles and Rails: Stainless steel channel secured with stainless steel screws every 10 inches.
3. Corners: Welded.

E. Face Sheet:
1. Material: SpecLite3 FRP, 0.120-inch thickness, finish color throughout.
2. Surface: Abuse-resistant engineered surface.
3. Texture: Pebble.
4. Colors: As selected by Architect.
5. Sheet type: Class C FRP.

F. Core:
1. Material: Mineral.
2. Density: Minimum 30 pounds per cubic foot.
3. Perimeter blocking: Minimum 1-1/2 inches wide.

G. Cutouts:
1. Manufacture doors with cutouts for required vision lites.
2. Factory install vision lites.

H. Door perimeter channel: Type 304 stainless steel, 3/4 inch by 1-7/8 inch by 0.062 inch.

I. Fasteners:
1. Material: Aluminum, 18-8 stainless steel or other noncorrosive metal.
2. Compatibility: Compatible with items to be fastened.
3. Exposed fasteners: Screws with finish matching items to be fastened.
4. Throughbolt surface mounted hardware.

J. Fire-Rated Hollow Metal Frames: As specified in Section 08 1113 “Hollow Metal Doors and Frames”.

K. Gaskets and Seals:
1. Gaskets: Pemko S88.
2. Smoke Seals: Pemko HSS2000, 1/2 inch wide.
3. Smoke Seals, Pair Doors, Meeting Stile: Pemko S77.

2.4 MATERIALS

A. Aluminum Members:
1. Extrusions: ASTM B 221.
2. Sheet and Plate: ASTM B 209.
3. Alloy and Temper: As required by manufacturer for strength, corrosion resistance, application of required finish, and control of color.

B. Components: Door and frame components from same manufacturer.

C. Fasteners:
1. Material: Aluminum, 18-8 stainless steel, or other noncorrosive metal.
2. Compatibility: Compatible with items to be fastened.
3. Exposed Fasteners: Screws with finish matching items to be fastened.

2.5 FABRICATION

A. Sizes and Profiles: Required sizes for door and frame units, and profile requirements shall be as indicated on the Drawings.

B. Coordination of Fabrication: Field measure before fabrication and show recorded measurements on shop drawings.

C. Assembly:
1. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.
2. Remove burrs from cut edges.

D. Welding: Welding of doors or frames is not acceptable.

E. Fit:
1. Maintain continuity of line and accurate relation of planes and angles.
2. Secure attachments and support at mechanical joints with hairline fit at contacting members.

2.6 ARCHITECTURAL PANELS

A. FRP Panels:
1. Model: SL-37 Architectural Panels with SpecLite3 FRP face sheets.
2. Thickness: 1 inch.

B. Face Sheets:
1. Material: SpecLite3 FRP, 0.120 inch thickness, finish color throughout. Abuse-resistant engineered surface.
2. Texture: Pebble.
3. Color: As selected by Architect.

C. Insulated SpecLite3 FRP Panels:
1. Insulated Panels: Two 0.120 inch minimum thickness sheets.
2. Core: Foam polyurethane core of a minimum of 5 pounds per cubic foot density.
3. Form components to function as a single unit.
4. R-Value: Minimum of 4 for 1 inch panels.

D. Class A Flame Spread and Smoke Developed Rating:
1. Class A flame spread and smoke developed rating on interior faces of exterior panels and both faces of interior panels.

2. Flame Spread, ASTM E 84: Maximum of 25.
3. Smoke Developed, ASTM E 84: Maximum of 450.

2.7 ALUMINUM DOOR FRAMING SYSTEMS

A. Tubular Framing:
1. Size and Type: As indicated on the Drawings.
2. Materials: Aluminum Alloy 6063-T5, 1/8-inch minimum wall thickness.
3. Applied Door Stops: 0.625-inch high, with screws and weatherstripping. Door stop shall incorporate pressure gasketing for weathering seal. Counterpunch fastener holes in door stop to preserve full metal thickness under fastener head.
4. Frame Members: Box type with 4 enclosed sides. Open-back framing is not acceptable.
5. Caulking: Caulk joints before assembling frame members.
6. Joints:
   a. Secure joints with fasteners.
   b. Provide hairline butt joint appearance.
7. Field Fabrication: Field fabrication of framing using stick material is not acceptable.
8. Applied Stops: For side, transom, and borrowed lites and panels. Applied stops shall incorporate pressure gasketing for weathering seal. Reinforce with solid bar stock fill for frame hardware attachments.
9. Hardware:
   a. Premachine and reinforce frame members for hardware in accordance with manufacturer's standards and hardware schedule.
   b. Factory install hardware.
10. Anchors:
   a. Anchors appropriate for wall conditions to anchor framing to wall materials.
   b. Door Jamb and Header Mounting Holes: Maximum of 24-inch centers.
   c. Secure head and sill members of transom, side lites, and similar conditions.

2.8 HARDWARE

A. Premachine doors in accordance with templates from specified hardware manufacturers and hardware schedule.

B. Factory install hinges, locksets and panic hardware.

C. Fire Rated Doors: Surface hardware must be throughbolted.

D. Hardware Schedule: As specified in Section 08 7111.

E. Finish: As specified in Section 08 7111.

2.9 VISION LITES

A. Factory Glazing: 1 inch glass.

B. Lites in Exterior Doors: Allow for thermal expansion.

C. Provide door manufacturer's standard lite kits, factory installed.

2.10 LOUVERS

A. Type: Door manufacturer's aluminum, inverted &-type, fixed blade, 12 inches minimum from bottom of door.

B. Installation: Factory installed into standard vision lite kit. Exterior side of louver shall be free of fasteners.

C. Insect screen.

2.11 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: Custom color as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Ensure openings to receive frames are plumb, level, square, and in tolerance.

3.3 INSTALLATION

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

B. Install doors plumb, level, square, true to line, and without warp or rack.

C. Anchor frames securely in place.

D. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by Architect.

E. Set thresholds in bed of mastic and backseal.

F. Install exterior doors to be weathertight in closed position.

G. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

H. Remove and replace damaged components that cannot be successfully repaired as determined by Architect.

3.4 ADJUSTING

A. Adjust doors, hinges, and locksets for smooth operation without binding.

3.5 CLEANING

A. Clean doors promptly after installation in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that would damage finish.

3.6 PROTECTION

A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

- END OF SECTION -

- SECTION 08 3113 -

ACCESS DOORS & FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Access doors and frames for walls and ceilings.
   2. Wall access doors and frames
   3. Fire-rated wall access doors and frames.
   4. Fire-rated ceiling access doors and frames.

1.3 RELATED SECTIONS

A. Section 07 7200 "Roof Accessories" for roof hatches.

B. Section 08 7111 "Door Hardware" for mortise or rim cylinder locks and master keying.

C. Section 09 2710 “Glass-Reinforced Gypsum Fabrications” for flush push up ceiling access panels in suspended gypsum board ceilings.

D. Section 09 5113 "Acoustical Tile Ceilings" for suspended acoustical tile ceilings.

E. Section 23 3000 "Ductwork Accessories" for heating and air-conditioning duct access doors.

1.4 SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each door face material, at least 3 by 5 inches (75 by 125 mm) in size, in specified finish.

D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of access door(s) and frame(s) through one source from a single manufacturer.

B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for vertical access doors and frames.
2. ASTM E 119 or UL 263 for horizontal access doors and frames.

C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.6 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

1. ASTM A 123/A 123M, for galvanizing steel and iron products
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

C. Steel Sheet: Uncoated or electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with A60 (ZF180) zinc-iron-alloy (galvannealed) coating or G60 (Z180) mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.

E. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Surface Preparation for Metallic-Coated Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
   a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
3. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.
4. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm). Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.

F. Drywall Beads: Edge trim formed from 0.0299-inch (0.76-mm) zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

G. Plaster Beads: Casing bead formed from 0.0299-inch (0.76-mm) zinc-coated steel sheet with flange formed out of expanded metal lath and in size to suit thickness of plaster.

2.2 STAINLESS-STEEL MATERIALS

A. Rolled-Stainless-Steel Floor Plate: ASTM A 793, manufacturer's standard finish.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines or blend into finish.

1. Finish: Manufacturer's standard.

2.3 ALUMINUM MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.

1. Mill finish, AA-M10 (Mechanical Finish: as fabricated, unspecified).

B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

1. Mill finish, AA-M10 (Mechanical Finish: as fabricated, unspecified).

C. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H15; with minimum sheet thickness indicated representing specified thickness according to ANSI H35.2 (ANSI H35.2(M)).

1. Mill Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

2.4 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

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

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

1. Babcock-Davis; A Cierra Products Co.
2. Dur-Red Products.
3. J. L. Industries, Inc.
4. Karp Associates, Inc.
5. Larsen's Manufacturing Company.
6. Milcor Inc.
7. Nystrom, Inc.

C. Flush Access Doors and Frames with Exposed Trim: Fabricated from stainless-steel sheet.

1. Locations: Wall surfaces (Wet Areas).
2. Door: Minimum 0.060-inch- (1.5-mm-) thick sheet metal, set flush with exposed face flange of frame.
3. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with 1-inch- (25-mm-) wide, surface-mounted trim.
4. Hinges: Spring-loaded, concealed-pin type.
5. Latch: Self-latching bolt operated by ring turn with interior release.
6. Lock: Cylinder.

D. Flush Access Doors and Trimless Frames: Fabricated from metallic-coated steel sheet.

1. Locations: Wall surfaces.
2. Door: Minimum 0.060-inch- (1.5-mm-) thick sheet metal, set flush with surrounding finish surfaces.
3. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with drywall bead flange.
4. Hinges: Spring-loaded, concealed-pin type.
5. Latch: Self-latching bolt operated by screwdriver with interior release.

E. Plastic Flush Access Doors and Frames with Exposed Trim: Fabricated from 1/8-inch- (3.2-mm-) thick high-impact plastic with UV stabilizer.

1. Locations: Ceiling surfaces.
2. Door: Flush to frame with rounded corners.
3. Frame: 1 piece, 3/4 inch (19 mm) deep.
4. Latch: Snap latch.

5. Finish: White with textured exposed surfaces.

F. Exterior Flush Access Doors and Frames with Exposed Trim: Weatherproof with extruded door gasket.
1. Locations: Wall and ceiling surfaces.
2. Door: Minimum 0.040-inch- (1.0-mm-) thick, metallic-coated steel sheet; flush panel construction with manufacturer's standard 2-inch- (50-mm-) thick fiberglass insulation.
3. Frame: Minimum 0.060-inch- (1.5-mm-) thick extruded aluminum.
4. Hinges: Continuous piano, zinc plated.
5. Lock: Dual-action handles with key lock.

G. Fire-Rated, Insulated, Flush Access Doors and Trimless Frames: Fabricated from metallic-coated steel sheet.
1. Locations: Wall and ceiling surfaces.
2. Fire-Resistance Rating: Not less than that of adjacent construction.
3. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch (0.9 mm).
5. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with drywall bead.
6. Hinges: Concealed-pin type Continuous piano.
7. Automatic Closer: Spring type.
8. Lock: Self-latching device with cylinder lock.

2.5 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
1. Exposed Flanges: Nominal 1 to 1-1/2 inches (25 to 38 mm) wide around perimeter of frame.
2. For trimless frames with drywall bead, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
3. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
4. Provide mounting holes in frames for attachment of units to metal or wood framing.
5. Provide mounting holes in frame for attachment of masonry anchors. Furnish adjustable metal masonry anchors.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
   1. For recessed doors with plaster infill, provide self-furring expanded metal lath attached to door panel.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
   1. For cylinder lock, furnish two keys per lock and key all locks alike.
   2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

F. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

- END OF SECTION -

- SECTION 08 3323 -

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of overhead coiling doors:
   1. Insulated Exterior Overhead Coiling Door, Motor Operated Type

1.3 RELATED SECTIONS:

A. Section 05 5000 “Metal Fabrications” for steel framing at jamb openings.

B. Section 08 7111 “Door Hardware” Cylinders for keyed control stations, roll down door cylinders, and keys provided by, and installed under this section.

C. Section 09 9600 “High Performance Coatings” for field paint finish.

D. Division 26 “Electrical” for electrical connections and control wiring.

1.4 SYSTEM REQUIREMENTS

A. Design Requirements: Contractor is responsible to coordinate with manufacturer of existing units for designing anchorage to structural system and necessary modifications to meet specified requirements and maintain visual design concepts.

B. Interface with Adjacent Systems:
   1. Integrate design and connections with adjacent construction.
   2. Accommodate allowable tolerances and deflections for structural members in installation.

1.5 SUBMITTALS

A. General: Submit in accordance with Section 01 3219.

B. Product Data: Submit product data, and rough-in requirements.

C. Shop Drawings:
   1. Submit drawings for components and installations which are not fully dimensioned or detailed on manufacturer's literature.
   2. Stamp shop drawings with seal and signature of professional engineer responsible for design.

D. Submit following Informational Submittals:
   1. Support reactions design data.
   2. Certifications specified in Quality Assurance article.
   3. Manufacturer's instructions.

E. Closeout Submittals:
   1. Submit under provisions of Section 01 7700.
   2. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. Exterior rolling service doors shall be designed to withstand at least twenty (20) pounds per square foot windload.

B. All rolling counter doors shall be designed to a standard maximum of 10 cycles per day and an overall maximum of 20,000 operating cycles for the life of the door

C. Fire Rated Assemblies:
   1. Provide assemblies which comply with NFPA 80 and have been tested, rated and labeled in accordance with ASTM E152, NFPA 252 or UL 10B.
   2. Identify each assembly with factory applied label indicating applicable fire rating.

D. Certifications:
   1. Submit certificates verifying AWS qualifications for each welder employed on Project.
   2. Submit manufacturer's certification that products furnished for Project meet or exceed specified requirements.
   3. Engineering certifications.

E. STC Requirements: See Door Schedule Sheet in Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. Cookson Company, The. *
   2. Cornell Iron Works Inc.
   3. Overhead Door Corporation
   4. Pacific Rolling Door Co.

5. Wayne Dalton Corporation

2.2 MATERIALS

A. Sheet Steel: Hot-dipped galvanized steel complying with ASTM A653, G90 zinc coating.

B. Steel Shapes and Plates: ASTM A36.

C. Gray Iron Castings: ASTM A48, Class 30B.

D. Primer: Manufacturer's standard coating.

2.3 TYPICAL COMPONENTS AND FABRICATION

A. Brackets: Manufacturer's standard design, cast iron or steel plate, secured to guide extensions and designed to support counterbalance assembly.

B. Locking Devices:
   1. Equip manual push-up operated assemblies with cylinder locking mechanism per Section 08 7111 on inside of bottom bar designed for securing into door track.
   2. Equip chain operated assemblies with slide bolt locking mechanism on inside of bottom bar designed for securing with padlock, or wall mounted device designed for securing chain with padlock; padlocks by Owner.

C. Seals: Equip exterior assemblies with neoprene or vinyl weather seals at curtain guides and in hood.

D. Automatic Closing for Fire Rated Assemblies:
   1. Fabricate assemblies to permit manual lifting of curtain for emergency exit after automatic closing, with curtain returning to closed position when released.
   2. Provide automatic closing device and adjustable speed governor that becomes operative upon melting of 160 degrees F fusible link.
   3. In addition, equip assemblies with electro-mechanical time delay release device activated by building fire alarm system. Provide time delay release device with following characteristics:
      a. UL listed for use with fire alarm system.
      b. Activate automatic closing.
      c. Equipped with time delay release action to prevent false drops due to momentary power outages or fire alarm test.
      d. Time delay feature adjustable up to one minute.
      e. Automatic resetting without need for factory authorized dealer involvement.
   4. Acceptable Product: SureFire, Cookson, or equivalent.

2.4 INSULATED SERVICE DOORS, MOTOR DRIVEN

A. Basis of Design: Products specified herein are manufactured by the Cookson Company to establish appearance, performance and quality required for this project.

B. The door curtain shall be constructed of interconnected strip steel slats conforming to ASTM A-653. The slats shall be as No. 45 (measuring 3" high by 7/8" deep) consisting of a 22 gauge exterior slat and a 22 gauge interior slat separated by 13/16" of rigid insulation for doors up to 24' wide, and 20 gauge exterior slat and a 22 gauge interior slat separated by 13/16" of rigid insulation for doors over 24' wide.

C. The finish on the door curtain shall have a finish coat consisting of the following:
   1. Hot dipped galvanized G-90 coating consistent with ASTM A-653
   2. Bonderized coating for prime coat adhesion
   3. Corrosion inhibiting primer .2 mils per side
   4. Thermosetting gray polyester top coat with a minimum thickness of .6 mils each side

D. The bottom bar shall consist of two 1/8" steel angles mechanically joined together and shall include the Cookson Featheredge, or similar safety edge system. The finish on the bottom bar shall be one (1) coat of bronze rust-inhibiting prime paint.

E. The guides shall consist of 3 steel angles bolted together with 3/8" fasteners to form a channel for the curtain to travel. Extruded vinyl snap-on weatherstripping shall be furnished continuously along the exterior leg of each guide. The wall angle portion shall be continuous and fastened to the surrounding structure with either minimum 1/2" fasteners or welds, both on 36" centers. The finish on the guide angles shall be one (1) coat of bronze rust-inhibiting prime paint.

F. The brackets shall be constructed of steel not less than 1/4" thick and shall be bolted to the wall angle with minimum 1/2" fasteners. The finish on the brackets shall be one (1) coat of bronze rust-inhibiting prime paint.

G. The barrel shall be steel tubing of not less than 6" in diameter. Oil tempered torsion springs shall be capable of correctly counter balancing the width of the curtain. The barrel shall be designed to limit the maximum deflection to .03" per foot of opening width. The springs shall be adjusted by means of an exterior wheel. The finish on the barrel shall be one (1) coat of bronze rust-inhibiting prime paint.

H. The hood shall be fabricated from 24-gauge galvanized steel and shall be formed to fit the curvature of the brackets. The hood shall contain a waterproof baffle to control air infiltration. The finish on the hood shall be the finish coat as indicated in the curtain section.

I. Operation
   1. The door shall be operated at a speed of 2/3 foot per second by an open drip-proof electric motor with gear reducer in oil bath. The motor operator shall include a geared limit switch, and an electrically interlocked emergency chain operator. The motor starter shall be housed in a NEMA 1 housing and include a magnetic reversing starter size 0, a 24 volt control transformer, and complete terminal strip to facilitate field wiring. The motor operator shall be activated, by a 3 button push-button station, in a NEMA 1 enclosure. The motor shall be size as required by the door 115 volts single phase. The motor operator shall be mounted to the door bracket as shown on drawings. All motor operators shall be U.L. listed.

2. The service door shall include the rolling door safety edge system as manufactured by The Cookson Company, or equivalent, and shall include the following features:
   a. The safety edge shall be installed on the bottom bar of the door and shall automatically reverse the door if the device detects an obstruction in the downward travel of the door.
   b. The safety edge shall consist of a rubber boot attached below the bottom bar with an electrical switch secured to the back of the bottom bar. The safety edge shall operate with air wave technology and shall not rely on pneumatic pressure or electrical strip contacts to operate properly. The safety edge shall create an air wave that shall be detected and reverse the direction of the rolling door.
   c. The operation of the safety edge shall not be subject to interferences by temperature, barometric pressure, water infiltration, or cuts in the rubber boot.
   d. The safety edge shall be connected to the motor operator with a coil cord.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Carefully examine all units to be relocated prior to removal. Replace all parts recommended by the original manufacture.

B. Examine conditions and proceed with Work when new substrates are ready.

C. Verify that openings are prepared with headers level, jambs plumb, floor level, without projections, and correctly dimensioned to receive assemblies.

3.2 INSTALLATION

A. Install assemblies and operating equipment complete with operators, and related accessories in accordance with Section 01 3219 and approved shop drawings.

B. Install fire rated assemblies to comply with NFPA 80.

C. Coordinate installation with electrical service and fire alarm system.

D. Upon completion of installation, including work by other trades, test and adjust curtains to operate easily, free from warp, twist or distortion.

E. Test automatic closing feature of fire rated assemblies. Adjust closing speed to comply with NFPA and Owner requirements.

F. Clean surfaces, joints and bearings of unit in accordance with manufacturer's instructions; lubricate as recommended by manufacturer.

3.3 SCHEDULE

A. Refer to Door Schedule for type, location, sizes, materials and finish.

- END OF SECTION -

- SECTION 08 4113 -

ALUMINUM FRAMED ENTRANCES & STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section describes the requirements for furnishing and installing aluminum framed storefronts, including exterior entrance doors, transoms, sidelights, and storefront-type framing system for the following:

1. Exterior storefront framing.
2. Storefront framing for window walls.
3. Exterior manual-swing entrance doors and door-frame units.

1.3 RELATED SECTIONS

A. Section 07 4215 “Glass Façade Panel System” for glass wall panel system at vertical wall surfaces and sloped soffit conditions.

B. Section 07 4219 “Metal Plate Wall Panels” for metal plate wall panels at vertical wall surfaces.

C. Section 07 9200 “Joint Sealants” for adhesion testing.

D. Section 08 7111 “Door hardware” for hardware not specified to be included with storefront manufacturer.

E. Section 08 8000 “Glazing” for interior and exterior glazing.

F. Section 08 9000 "Louvers And Vents" for units installed with aluminum-framed systems.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide aluminum entrances and storefront assemblies that comply with performance characteristics specified, as demonstrated by testing the manufacturer's corresponding stock assemblies according to specified test methods.

B. Thermal Movement: Design the aluminum entrance and storefront framing systems to provide for expansion and contraction of the component materials resulting from a surface temperature range of 180-deg. F. without buckling, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, stress on glass, or other detrimental effects. Entrance doors shall function normally over the specified temperature range.

C. Wind Loads: Provide aluminum entrance and storefront framing system, including anchorage, capable of withstanding wind-load design pressures calculated according to the requirements of CBC Chapter 16, Division II.

D. Structural Performance: Conduct tests for structural performance in accordance with ASTM E330. At the conclusion of the tests there shall be no glass breakage or permanent damage to fasteners, anchors, hardware or actuating mechanism. Framing members shall have no permanent deformation in excess of 0.2-percent of their clear span.

1. Deflection Normal to Plane of the Wall: Test pressure required to measure deflection of framing members normal to the plane of the wall shall be equivalent to the specified wind load. Deflection shall not exceed 1/175 of the clear span, when subjected to uniform load deflection test.
2. Deflection Parallel to the Plane of the Wall: Test pressures required to measure deflection parallel to the plane of the wall shall be equal to 1.5 times the specified wind pressure. Deflection of any member carrying its full dead load shall not exceed an amount that will reduce glass bite below 75-percent of the design dimension and shall not reduce the edge clearance between the member and the fixed panel, glass or other fixed member above to less than 1/8-inch. The clearance between the member and an operable door or window shall be at least 1/16-inch.

E. Air Infiltration: Provide aluminum entrance and storefront framing system with an air infiltration rate of not more than 0.06-cfm per sq. ft. of fixed area, excluding operable door edges, when tested in accordance with ASTM E283 at an inward test pressure differential of 1.57-psf.

F. Water Penetration: Provide framing systems with no uncontrolled water penetration, excluding operable door edges, as defined in the test method when tested in accordance with ASTM E331 and E547 at an inward test pressure differential of 6.24-psf. Water penetration must include compensation channels, if used.

1.5 SUBMITTALS

A. Product Data: Furnish product data for each system showing manufacturer's standard details and fabrication methods, data on finishing, and accessories, and recommendations for maintenance and cleaning.

B. LEED Submittal:

1. Product Data for Credit EQ 4.1: For adhesives and sealants used inside of the weatherproofing system, including printed statement of VOC content.

C. Shop Drawings: Furnish shop drawings for each system showing layout and installation details, including relationship to adjacent work, elevations at 1/4-inch scale, detail sections of typical composite members, anchors and reinforcement, hardware mounting heights, provisions for expansion and contraction, and glazing details.

D. Samples for Verification: Furnish samples of each type and color of aluminum finish selected, on 12-inch long sections of extrusions or formed shapes and 6-inch square sheets.

E. Test Reports: Furnish certified test reports from a qualified independent testing laboratory showing that aluminum entrance and storefront framing systems have been tested in accordance with specified test procedures and comply with specified performance characteristics.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: A minimum of 5-years experience in the manufacture of aluminum entrances and storefronts of the types specified.

B. Installer's Qualifications: Minimum 5-years experience in the installation of systems similar to those required.

C. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

D. Quality-Control Program for Structural-Sealant-Glazed System: Develop quality control program specifically for Project. Document quality-control procedures and verify results for aluminum-framed systems. Comply with ASTM C 1401 recommendations including, but not limited to, system material-qualification procedures, preconstruction sealant-testing program, procedures for system fabrication and installation, and intervals of reviews and checks.

E. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. 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. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

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

F. Preconstruction Sealant Testing: For structural-sealant-glazed systems, perform sealant manufacturer's standard tests for compatibility with and adhesion of each material that will come in contact with sealants and each condition required by aluminum-framed systems.

1. Test a minimum five samples each of metal, glazing, and other material.
2. Prepare samples using techniques and primers required for installed systems.
3. For materials that fail tests, determine corrective measures necessary to prepare each material to ensure compatibility with and adhesion of sealants including, but not limited to, specially formulated primers. After performing these corrective measures on the minimum number of samples required for each material, retest materials.

G. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

H. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

I. Structural-Sealant Glazing: Comply with ASTM C 1401, "Guide for Structural Sealant Glazing" for design and installation of structural-sealant-glazed systems.

J. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

K. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

L. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical wall area as shown on Drawings.
   2. Field testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
   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.
   4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

M. Preinstallation Conference: Conduct conference at Project site.

N. Manufacturers installation procedures and shop drawings must be kept on-site throughout the construction of the projects

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver aluminum entrance and storefront components in the manufacturer's original protective packaging.

B. Store aluminum components in a clean, dry location away from uncured stucco, masonry or concrete. Cover components with waterproof paper, tarpaulin or polyethylene sheeting in a manner to permit circulation of air.
   1. Stack framing components in a manner that will prevent bending and avoid significant or permanent damage.

1.8 PROJECT CONDITIONS

A. Field Measurements: Check openings by accurate field measurement before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication with construction progress to avoid delay of the work.
   1. When necessary, proceed with fabrication without field measurements, and coordinate fabrication tolerances to ensure proper fit.

1.9 WARRANTY

A. Furnish written warranty covering aluminum entrances and storefronts that fail in materials or workmanship within 3-years from date of Substantial Completion. Failures include, but are not limited to structural failures including excessive deflection, excessive leakage or air infiltration, faulty operation, and deterioration of metals, metal finishes, and other materials beyond normal weathering.

1. Warranty shall cover all components installed as part of the framed entrances and storefronts.

B. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

C. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

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

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design Product: The design for offset glazed aluminum-framed systems is based on "Series OS451" and "Series OS601" manufacturer by United States Aluminum, Waxahachie, TX. Tel: (800) 627-6440 or (972) 937-9651, web: www.usalum.com , or subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Kawneer North America; an Alcoa company.
2. United States Aluminum.
3. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.

B. Entrance Doors:

1. Basis of Design: Entrance Doors: Model "550 Wide Stile", heavy duty as manufactured by United States Aluminum, or subject to compliance with requirements, provide a comparable product by one of the manufactures above.

2.2 MATERIALS

A. Aluminum Members: 6063-T5 alloy and temper.

B. Fasteners: Aluminum or Series 300 nonmagnetic stainless steel.

1. Do not use exposed fasteners except for application of hardware. For application of hardware, use Phillips flat-head machine screws that match the finish of member or hardware item being fastened.

C. Concealed Flashing: Dead-soft stainless steel or extruded aluminum as selected by manufacturer for compatibility with other components.

D. Brackets and Reinforcements: Aluminum or nonmagnetic stainless steel. Provide non-staining, non-ferrous shims for installation and alignment as required.

E. Weatherstripping: Manufacturer's standard replaceable type. Provide weatherstripping on meeting stiles of pairs of doors and at bottom rail of each door leaf.

2.3 COMPONENTS

A. Storefront Framing Systems: Provide storefront, entrance framing systems, and sunscreens fabricated from extruded aluminum members of size and profile indicated. Include subframes and other reinforcing members as required. Provide for flush glazing storefront from the exterior on all sides without projecting stops. Shop-fabricate and pre-assemble frame components where possible. Provide storefront frame sections without exposed seams.

1. Mullion Configuration: Provide pockets at the inside glazing face to receive resilient elastomeric glazing. Mullions and horizontals shall be one piece. Make provisions to drain moisture accumulation to the exterior.

B. Stile-and-Rail Type Entrance Doors: Door corner construction shall consist of mechanical clip fastening, SIGMA deep penetration and fillet welds.

1. Glazing: Fabricate doors to facilitate replacement of glass or aluminum panels, without disassembly of stiles and rails. Provide snap-on extruded aluminum glazing stops, with exterior stops anchored for non-removal.
2. Design: 1-3/4-inch thick, stile and rail dimensions as indicated.
3. Each door leaf shall be equipped with an adjusting mechanism located in the top rail near the lock stile, which provides for minor clearance adjustments after installation.

2.4 ENTRANCE DOOR SYSTEMS

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

1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch-(3.2-mm-) 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.
2. Door Design: Wide stile; 5-inch (127-mm) nominal width.
   a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches (255 mm) above floor or ground plane.
3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
   a. Provide nonremovable glazing stops on outside of door.

B. Entrance Door Hardware: As specified in Division 8 Section "Door Hardware."

2.5 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."

1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (0.762-mm) thickness per coat.

2.6 FABRICATION

A. General: Fabricate aluminum entrance and storefront components to designs, sizes and thickness indicated, and to comply with specified standards. Sizes and profile requirements are indicated on the drawings.

B. Prefabrication: Complete fabrication, assembly, finishing, hardware application, and other work before shipment to Project site. Disassemble components only where necessary for shipment and installation.

1. Perform fabrication operations, including cutting, fitting, forming, drilling and grinding of metal work to prevent damage to exposed finish surfaces. Complete these operations for hardware prior to application of finishes.
2. Do not drill and tap for surface-mounted hardware items until time of installation at Project site.

C. Framing Members, General: 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. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing interior for vision glass and exterior for spandrel glazing or metal panels.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

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

1. At exterior doors, provide compression weather stripping at fixed stops.
2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

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

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

F. 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.

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

H. Welding: Comply with AWS recommendations. Grind exposed welds smooth to remove weld spatter and welding oxides. Restore mechanical finish.

1. Welding behind finished surfaces shall be performed to minimize distortion and discoloration on the finished surface.

I. Reinforcing: Install reinforcing as required for hardware, performance requirements, sag resistance and rigidity.

J. Dissimilar Metals: Separate dissimilar metals with bituminous paint, suitable sealant, elastomeric tape, or gasket between the surfaces. Do not use coatings containing lead.

K. Continuity: Maintain accurate relation of planes and angles with hairline fit of contacting members.

L. Conceal fasteners wherever possible.

M. Weatherstripping: For exterior doors, provide compression weatherstripping against fixed stops. At other edges, provide sliding weatherstripping retained in adjustable strip mortised into door edge.

2.7 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: TBD.

2.8 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to evaluate structural-sealant-glazed systems.

B. Structural-Sealant-Glazed Systems: Perform quality-control procedures complying with ASTM C 1401 recommendations, including, but not limited to, system material-qualification procedures, sealant testing, and system fabrication reviews and checks.

C. Structural-sealant-glazed system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's instructions and recommendations for installation.

B. Set units plumb, level, and true to line, without warp or rack of framing members, doors, or panels. Install components in proper alignment and relation to established lines. Provide proper support and anchor securely in place

C. Installation Tolerances:
   1. Variation from Plane: Do not exceed 1/8-inch in 12-feet of length or 1/4-inch in any total length.
   2. Offset from Alignment: The maximum offset from true alignment between two identical members abutting end-to-end in line shall not exceed 1/16-inch.
   3. Diagonal Measurements: The maximum difference in diagonal measurements shall not exceed 1/8-inch.
   4. Offset at Corners: The maximum out-of-plane offset of framing at corners shall not exceed 1/32-inch.

D. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
   1. Paint dissimilar metals where drainage from them passes over aluminum.
   2. Paint aluminum surfaces in contact with mortar, concrete or other masonry with alkali-resistant coating.
   3. Paint wood and similar absorptive material in contact with aluminum and exposed to the elements or otherwise subjected to wetting, with 2-coats of aluminum house paint. Seal joints between the materials with sealant.

E. Drill and tap frames and doors and apply surface-mounted hardware in compliance with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.

F. Set sill members and other members in bed of sealant, or use joint fillers or gaskets to provide weathertight construction. Comply with requirements of Section 07 9200.

G. Where flashings are indicated adjacent to work specified in this Section, provide flashings in 0.040-inch aluminum, finished to match entrances and storefronts.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.

1. Structural-Sealant Glazing Inspection: After installation of aluminum-framed systems is complete, structural-sealant glazing shall be inspected and evaluated according to ASTM C 1401 recommendations.
2. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing under "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft. (0.03 L/s per sq. m), of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).
3. Water Spray Test: Before installation of interior finishes has begun, a minimum area of 75 feet (23 m) by 1 story of aluminum-framed systems designated by Project Manager shall be tested according to AAMA 501.2 and shall not evidence water penetration.

C. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.3 ADJUSTING

A. Entrances: Adjust operating hardware for smooth operation according to hardware manufacturers' written instructions, providing smooth operation without binding, and to prevent tight fit at contact points and weatherstripping.

1. For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches (75 mm) from the latch measured to the leading door edge.

3.4 CLEANING

A. Clean the completed system, inside and out, promptly after installation, exercising care to avoid damage to coatings.

B. Clean glass surfaces after installation, complying with the requirements specified in Section 08800. Remove excess glazing and sealant compounds, dirt and other substances from aluminum surfaces.

3.5 PROTECTION

A. Institute protective measures required throughout the remainder of the construction period to ensure that aluminum entrances and storefronts will be without damage or deterioration, other than normal weathering, at time of acceptance

- END OF SECTION -

- SECTION 08 7111 -

FINISH HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

B. This Section includes the following, but is not necessarily limited to:

1. Door Hardware, including electric hardware.
2. Storefront and Entrance door hardware.
3. Gate Hardware.
4. Digital keypad access control devices.
5. Hold-open closers with smoke detectors.
6. Wall or floor-mounted electromagnetic hold-open devices.
7. Power supplies for electric hardware.
8. Low-energy door operators plus actuators.
9. Thresholds, gasketing and weather-stripping.
10. Door silencers or mutes.

C. Related Sections: The following sections are noted as containing requirements that relate to this Section, but may not be limited to this listing.

1. Division 8: Section - Steel Doors and Frames.
2. Division 8: Section - Wood Doors. FRP Doors
3. Division 8: Section - Aluminum Storefront
4. Division 28: Section - Fire/Life-Safety Systems & Security Access Systems.

1.3 REFERENCES (USE DATE OF STANDARD IN EFFECT AS OF BID DATE.)

A. ADAAG - Americans with Disabilities Act (ACT) Accessibility Guidelines for Buildings and Facilities.

B. BHMA - Builders' Hardware Manufacturers Association.

C. CCR - California Code of Regulations, Tile 24, Part 2, California State Accessibility Standards.

D. DHI - Door and Hardware Institute.

E. NFPA - National Fire Protection Association.
   1. NFPA 80 - Fire Doors and Windows
   2. NFPA 101 - Life Safety Code
   3. NFPA 105 - Smoke and Draft Control Door Assemblies

F. CBC 2001 - California Building Code.

G. UL - Underwriters Laboratories.
   1. UL 10C - Fire Tests of Door Assemblies
   2. UL 305 - Panic Hardware

H. WHI - Warnock Hersey Incorporated

I. SDI - Steel Door Institute

1.4 SUBMITTALS & SUBSTITUTIONS

A. General: Submit in accordance with Conditions of the Contract and Division 1 Specification sections.

B. Submit product data (catalog cuts) including manufacturers' technical product information for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

C. Submit six (6) copies of schedule organized vertically into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening. Include following information:

   1. Type, style, function, size and finish of each hardware item.
   2. Name, part number and manufacturer of each item.
   3. Fastenings and other pertinent information.
   4. Location of hardware set coordinated with floor plans and door schedule.
   5. Explanation of all abbreviations, symbols and codes contained in schedule.
   6. Mounting locations for hardware.
   7. Door and frame sizes and materials.
   8. List of manufacturers used and their nearest representative with address and phone number.
   9. Keying information.

D. Make substitution requests in accordance with Division 1. Substitution requests must be made prior to bid date. Include product data and indicate benefit to the project. Furnish samples of any proposed substitution.

E. Wiring Diagrams: Provide product data and wiring and riser diagrams for all electrical products listed in the Hardware Schedule portion of this section.

F. Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

G. Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

H. Furnish as-built/as-installed schedule with close-out documents, including keying schedule, wiring/riser diagrams, manufacturers' installation, adjustment and maintenance information.

1.5 QUALITY ASSURANCE

A. Obtain each type of hardware (latch and lock sets, hinges, closers, exit devices, etc.) from a single manufacturer.

B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this project and that employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.

1. Responsible for detailing, scheduling and ordering of finish hardware.
2. Meet with Owner to finalize keying requirements and to obtain final instructions in writing.
3. Stock parts for products supplied and be capable of repairing and replacing hardware items found defective within warranty periods.

C. Hardware Installer: Company specializing in the installation of commercial door hardware with five years documented experience.

D. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not.

E. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL label on exit devices indicating "Fire Exit Hardware".

F. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.

1.6 DELIVERY, STORAGE AND HANDLING

A. Coordinate delivery of packaged hardware items to the appropriate locations (shop or field) for installation.

B. Hardware items shall be individually packaged in manufacturers' original containers, complete with proper fasteners. Clearly mark packages on outside to indicate contents and locations in hardware schedule and in work.

C. Provide locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, etc.

D. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

1.7 WARRANTY

A. Provide warranties of respective manufacturers' regular terms of sale from day of final acceptance as follows:
   1. Locksets: Seven (7) years.
   2. Closers: Ten (10) years, except electronic closers shall be two (2) years.
   3. Exit devices: Three (3) years.
   4. All other hardware: Two (2) years.

1.8 MAINTENANCE

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.

1.9 PRE-INSTALLATION CONFERENCE

A. Convene a pre-installation conference at least one week prior to beginning work of this section.

B. Attendance: Architect, Construction Manager, Contractor, Security Contractor, Hardware Supplier, Installer, and Key District Personnel.

C. Agenda: Review hardware schedule, products, installation procedures and coordination required with related work. Review District's keying standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

	Item	Manufacturer	Acceptable Substitutes
A.	Hinges	Ives	Hager, Stanley, McKinney
B.	Locks, Latches & Cylinders	Schlage	None
C.	Exit Devices	Von Duprin	None
D.	Closers	LCN	None
E.	Push, Pulls & Protection Plates	Ives	Trimco, BBW, Quality
F.	Flush Bolts	Ives	Trimco, BBW, Quality
G.	Dust Proof Strikes	Ives	Trimco, BBW, Quality
H.	Coordinators	Ives	Trimco, BBW, Quality
I.	Stops	Ives	Trimco, BBW, Quality

J.	Overhead Stops	Glynn-Johnson	None
K.	Thresholds	National Guard	Pemko, Zero
L.	Seals & Bottoms	National Guard	Pemko, Zero

2.2 MATERIALS

A. Hinges: Exterior out-swinging door butts shall be non-ferrous material and shall have stainless steel hinge pins. All doors to have non-rising pins.

1. Hinges shall be sized in accordance with the following:
   a. Height:
      1) Doors up to 41" wide: 4-1/2" inches.
      2) Doors 42" to 48" wide: 5 inches.
   b. Width: Sufficient to clear frame and trim when door swings 180 degrees.
   c. Number of Hinges: Furnish 3 hinges per leaf to 7'-5" in height. Add one for each additional 2 feet in height.
2. Furnish non-removable pins (NRP) at all exterior out-swing doors and interior key lock doors with reverse bevels.

B. Floor Closers: Shall be equipped with compression springs, cam and roller operating mechanism and a one piece spindle-cam for maximum operating performance and longevity.

C. Pivots: High strength forgings and castings with precision bearings for smooth operation. Positive locking vertical adjustment mechanism to allow installer to precisely position the door and balance the load.

D. Continuous Hinges: As manufactured by Ives, an Ingersoll-Rand Company. UL rated as required.

E. Heavy Duty Cylindrical Locks and Latches: Schlage "ND" Series as scheduled with "Sparta" design, fastened with through-bolts and threaded chassis hubs.

1. Locksets to comply with ANSI A156.2, Series 4000, Grade 1; tested to exceed 3,000,000 cycles. Locksets shall meet ANSI A117.1, Accessible Code.
2. Chassis: One piece modular assembly and multi-functional allowing function interchange without disassembly of lockset.
3. Spindle shall be deep-draw manufactured not stamped. Spindle and spring cage to be one-piece integrated assembly.
4. Anti-rotation plate to be interlocking to the lock chassis. Lock design utilizing bit-tabs are not acceptable.
5. Lever Trim: Accessible design, bi-directional, independent assemblies.
6. Locks shall be of such construction that when locked, the door may be opened from within by using lever and without the use of a key or special knowledge.
7. Thru-bolts to secure anti-rotation plate without sheer line. Fully threaded thru-bolts are not acceptable.
8. Spring cage to have double compression springs. Manufacturers utilizing torsion springs are not acceptable.
9. Latchbolt to be steel with minimum ½" throw deadlatch on keyed and exterior functions; ¾" throw anti-friction latchbolt on pairs of doors.

10. Strikes: ANSI curved lip,1-1/4" x 4-7/8", with 1" deep dust box (K510-066). Lips shall be of sufficient length to clear trim and protect clothing.

F. Deadlocks: Rotating cylinder trim rings of attack-resistant design. Mounting plates and actuator shields of plated cold-rolled steel. Mounting screws of ¼" diameter steel and protected by drill-resistant ball bearings. Steel alloy deadbolt with hardened steel roller. Strike alloy deadbolt with reinforcer and two 3" long screws. ANSI A156.5, 2001 Grade 1 certified.

G. Exit devices: Von Duprin as scheduled.

1. Provide certificate by independent testing laboratory that device has completed over 1,000,000 cycles and can still meet ANSI/BHMA A156.3 - 2001 standards.
2. All internal parts shall be of cold-rolled steel with zinc dichromate coating.
3. Mechanism case shall have an average thickness of .140".
4. Compression spring engineering.
5. Non-handed basic device design with center case interchangeable with all functions.
6. All devices shall have quiet return fluid dampeners.
7. All latchbolts shall be deadlocking with ¾" throw and have a self-lubricating coating to reduce friction and wear.
8. Device shall bear UL label for fire and or panic as may be required.
9. All surface strikes shall be roller type and utilize a plate underneath to prevent movement.
10. Lever Trim: "Breakaway" design, forged brass or bronze escutcheon with a minimum of .130" thickness, match lockset lever design.
11. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key.
12. Furnish glass bead kits for vision lites where required.
13. All Exit Devices to be sex-bolted to the doors.
14. Panic Hardware shall comply with UBC Standard 10-4 and shall be mounted between 30" and 44" above the finished floor surface. The unlatching force shall not exceed 15 lbs. applied in the direction of travel. Panic hardware shall comply with CBC Section 1003.3.1.9.

H. Closers: LCN as scheduled. Place closers inside building, stairs, room, etc.

1. Door closer cylinders shall be of high strength cast iron construction with double heat treated pinion shaft to provide low wear operating capabilities of internal parts throughout the life of the installation. All door closers shall be tested to ANSI/BHMA A156.4 test requirements by a BHMA certified testing laboratory. A written certification showing successful completion of a minimum of 10,000,000 cycles must be provided.
2. All door closers shall be fully hydraulic and have full rack and pinion action with a shaft diameter of a minimum of 11/16 inch and piston diameter of 1 inch to ensure longevity and durability under all closer applications.
3. All parallel arm closers shall incorporate one piece solid forged steel arms with bronze bushings. 1-9/16" steel stud shoulder bolts, shall be incorporated in regular arms, hold-open arms, arms with hold open and stop built in. All other closers to have forged steel main arms for strength, durability, and aesthetics for versatility of trim accommodation, high strength and long life.

4. All parallel arm closers so detailed shall provide advanced backcheck for doors subject to severe abuse or extreme wind conditions. This advanced backcheck shall be located to begin cushioning the opening swing of the door at approximately 45 degrees. The intensity of the backcheck shall be fully adjustable by tamper resistant non-critical screw valve.
5. Closers shall be installed to permit doors to swing 180 degrees.
6. All closers shall utilize a stable fluid withstanding temperature range of 120 degrees F. to -30 degrees F. without requiring seasonal adjustment of closer speed to properly close the door.
7. Provide the manufactures drop plates, brackets and spacers as required at narrow head rails and special frame conditions. NO wood plates or spacers will be allowed.
8. Maximum effort to operate closers shall not exceed 5 lbs., such pull or push effort being applied at right angles to hinged doors. Compensating devices or automatic door operators may be utilized to meet the above standards. When fire doors are required, the maximum effort to operate the closer may be increased but shall not exceed 15 lbs., when specifically approved by fire marshal. All closers shall be adjusted to operate with the minimum amount of opening force and still close and latch the door. These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position. Door shall take at least 5 seconds to move from an open position of 70 degrees to a point of 3 inches from the latch jamb. Reference CBC Sections 1133B.2.1, 1133B.2.5, 1133B2.5.1 & 1003.3.1.8.
9. Provide sex-bolted or through bolt mounting for all door closers.

I. Flush Bolts & Dust Proof Strikes: Automatic Flush Bolts shall be of the low operating force design. Utilize the top bolt only model for interior doors where applicable and as permitted by testing procedures.
1. Manual flush bolts only permitted on storage or mechanical openings as scheduled.
2. Provide dust proof strikes at openings using bottom bolts.

J. Door Stops:
1. Unless otherwise noted in Hardware Sets, provide wall type with appropriate fasteners. Where wall type cannot be used, provide floor type. If neither can be used, provide overhead type.
2. Do not install floor stops more than four (4) inches from the face of the wall or partition (Title 24, 1133B.8.6).
3. Overhead stops shall be made of stainless steel and non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.

K. Protection Plates: Fabricate either kick, armor, or mop plates with four beveled edges. Provide kick plates 10" high and 2" LDW. Sizes of armor and mop plates shall be listed in the Hardware Schedule. Furnish with machine or wood screws of bronze or stainless to match other hardware.

L. Thresholds: As Scheduled and per details.
1. Thresholds shall not exceed 1/2" in height, with a beveled surface of 1:2 maximum slope.
2. Set thresholds in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements in Division 7 “Thermal and Moisture Protection”.
3. Use ¼” fasteners, red-head flat-head sleeve anchors (SS/FHSL).
4. Thresholds shall comply with CBC Section 1133B.2.4.1.

M. Seals: Provide silicone gasket at all rated and exterior doors.
   1. Fire-rated Doors, Resilient Seals: UL10C / UBC Standard 7-2 compliant. Coordinate with selected door manufacturers' and selected frame manufacturers' requirements.
   2. Fire-rated Doors, Intumescent Seals: Furnished by selected door manufacturer. Furnish fire-labeled opening assembly complete and in full compliance with UL10C / UBC Standard 7-2. Where required, intumescent seals vary in requirement by door type and door manufacture -- careful coordination required.
   3. Smoke & Draft Control Doors, Provide UL10C / UBC Standard 7-2 compliant for use on "S" labeled Positive Pressure door assemblies.

N. Door Shoes & Door Top Caps: Provide door shoes at all exterior wood doors and top caps at all exterior out-swing doors.

O. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors. Omit where sound or light seals occurs, or for fire-resistive-rated door assemblies.

2.3 KEYING

A. Furnish a Grand Master, Master, keyed alike or keyed different system as directed by the Owner or Architect. This is an existing Schlage Classic "F" and "Primus FP" keying system. Conduct a keying meeting with the Owner prior to ordering any locks or cylinders.

B. Provide construction keying for doors requiring locking during construction; remove temporary cores or inserts immediately prior to Owner occupancy. Furnish permanent keys (and cores if applicable) directly to Owner.

C. Key Blanks: Standard "6" pin bow key blank; tag to identify.

D. Supply keys and blanks as follows:
   1. Supply 2 cut change keys for each different change key code.
   2. Supply 1 uncut key blank for each change key code.
   3. Supply 6 cut master keys for each different master key set.
   4. Supply 3 uncut key blanks for each master key set.

2.4 FINISHES

A. Generally to be satin chrome US26D (626 on bronze and 652 on steel) unless otherwise noted.

B. Furnish push plates, pull plates and kick or armor plates in satin stainless steel US32D (630) unless other wise noted.

C. Door closers shall be powder-coated to match other hardware, unless otherwise noted.

D. Aluminum items to be finished anodized aluminum except thresholds which can be furnished as standard mill finish.

2.5 FASTENERS

A. Screws for strikes, face plates and similar items shall be flat head, countersunk type, provide machine screws for metal and standard wood screws for wood.

B. Screws for butt hinges shall be flathead, countersunk, full-thread type.

C. Fastening of closer bases or closer shoes to doors shall be by means of sex bolts and spray painted to match closer finish.

D. Provide expansion anchors for attaching hardware items to concrete or masonry.

E. All exposed fasteners shall have a phillips head.

F. Finish of exposed screws to match surface finish of hardware or other adjacent work.

G. All Exit Devices and Lock Protectors shall be fastened to the door by the means of sex bolts or through bolts.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that doors and frames are square and plumb and ready to receive work and dimensions are as instructed by the manufacturer.

B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and requirements of DHI.

B. Use the templates provided by hardware item manufacturer.

C. Mounting heights for hardware shall be as recommended by the Door and Hardware Institute. Operating hardware will to be located between 30" and 44" AFF.

D. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

E. Drill and countersink units that are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

F. Set thresholds for exterior doors in full bed of butyl-rubber sealant.

G. If hand of door is changed during construction, make necessary changes in hardware at no additional cost.

H. Hardware Installer shall coordinate with security contractor to route cable to connect electrified locks, panic hardware and fire exit hardware to power transfers or electric hinges at the time these items are installed so as to avoid disassembly and reinstallation of hardware.

I. Hardware Installer shall also be present with the security contractor when the power is turned on for the testing of the electronic hardware applications. Installer shall make adjustments to solenoids, latches, vertical rods and closers to insure proper and secure operation.

3.3 ADJUST AND CLEAN

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

B. Clean adjacent surface soiled by hardware installation.

C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy, return to that work area and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware finishes, during the final adjustment of hardware.

E. Continued Maintenance Service: Approximately six months after the completion of the project, the Contractor accompanied by the Architectural Hardware Consultant, shall return to the project and re-adjust every item of hardware to restore proper functions of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

3.4 LOCATIONS

A. Conform to CCR, Title 24, Part 2, and ADAAG for positioning requirements for the disabled.

3.5 FIELD QUALITY CONTROL

A. Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and it's installation have been furnished and installed in accordance with manufacturer's instructions and as specified herein.

3.6 SCHEDULE

A. The items listed in the following schedule shall conform to the requirements of the foregoing specifications.

B. The Door Schedule on the Drawings indicates which hardware set is used with each door.

Manufacturers Abbreviations (Mfr.)

ADA	=	Adams Rite Mfg.	Aluminum Door Hardware
GLY	=	Glynn-Johnson Corporation	Overhead Door Stops
IVE	=	Ives	Hinges, Pivots, Bolts, Coordinators, Dust Proof Strikes, Push Pull & Kick Plates, Door Stops & Silencers
LCN	=	LCN	Door Closers
NGP	=	National Guard Products	Thresholds, Gasketing & Weather-stripping

SCE	=	Schlage Electronics	Electronic Door Components
SCH	=	Schlage Lock Company	Locks, Latches & Cylinders
VON	=	Von Duprin	Exit Devices

SPECWORKS # 75680-B6SZ3G56S

HW SET: 01 EXTERIOR PAIR GLASS DOORS / ACCESS CONTROL
DOOR NUMBER:
101.1 201.1

EACH TO HAVE:

2	EA	FLOOR CLOSER	SC28 PH 105 NHO	626	RIX
2	EA	PIVOT SET	TO BE DETERMINED		RIX
2	EA	PANIC HARDWARE	H-100B	630	BLU
2	EA	MORTISE CYLINDER	20-771 (FOR BLUMCRAFT)	626	SCH
1	EA	ELECTRIC STRIKE	310-1 (SPECIFY VOLTAGE & LATCHBOLT KEEPER)	630	FOL
1	EA	THRESHOLD	PER DETAIL	628	
1	EA	CARD READER	PROVIDED UNDER DIVISION 28 1300		
2	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	POWER SUPPLY	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		

HW SET: 02 EXTERIOR PAIR GLASS DOORS / ACCESS CONTROL / CARD READER / AUTO OPERATOR
DOOR NUMBER:
101.2 201.2

EACH TO HAVE:

2	EA	PIVOT SET	TO BE DETERMINED		RIX
2	EA	PANIC HARDWARE	H-100B	630	BLU
2	EA	MORTISE CYLINDER	20-771 (FOR BLUMCRAFT)	626	SCH
1	EA	ELECTRIC STRIKE	310-1 (SPECIFY VOLTAGE & LATCHBOLT KEEPER)	630	FOL
1	EA	AUTO. OPERATOR	2863 CP	628	LCN
1	EA	THRESHOLD	PER DETAIL	628	
1	EA	CARD READER	PROVIDED UNDER DIVISION 28 1300		
2	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	POWER SUPPLY	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		
2	EA	ACTUATOR, WALL MOUNT	8310-856		LCN
2	EA	ESCUTCHEON	8310-874	630	LCN

NOTE: HEADER REQUIRED FOR AUTO OPERATOR

HW SET: 03 INTERIOR / ALUM STOREFRONT / DIVISION WAITING, WELLNESS
DOOR NUMBER:
102.1 138

EACH TO HAVE:

1	SET	PIVOT SET	7215	626	IVE
1	EA	PIVOT	7215 INT	626	IVE
1	EA	CLASSROOM LOCK	ND70RD SPA	626	SCH
1	EA	SURFACE CLOSER	4041 X 18G MTG PLATE (TOP JAMB MOUNTED)	689	LCN
1	EA	DOME STOP	FS436	626	IVE
1	SET	DOOR SEALS	SUPPLY WITH DOOR AND FRAME ASSEMBLY		
1	EA	SILL	PER DETAIL	628	

HW SET: 04 INTERIOR / ALUM STOREFRONT / OFFICE
DOOR NUMBER:
102.2 102.3

EACH TO HAVE:

1	SET	PIVOT SET	7215	626	IVE
1	EA	PIVOT	7215 INT	626	IVE
1	EA	OFFICE LOCK	ND50RD SPA	626	SCH
1	EA	OVERHEAD STOP	100S	630	GLY
1	SET	DOOR SEALS	SUPPLY WITH DOOR AND FRAME ASSEMBLY		
1	EA	SILL	PER DETAIL	628	

HW SET: 04A INTERIOR / ALUM STOREFRONT / OFFICE, MEETING
DOOR NUMBER:

103.1	136	241	243.2	245	247
249	251	302	304	319	322
324	326	328	329.1	330	332
334	335	336.1	336.2	338	340.1
372.1	372.2	373	375	377	379
381	383				

EACH TO HAVE:

1	SET	PIVOT SET	7215	626	IVE
1	EA	PIVOT	7215 INT	626	IVE
1	EA	OFFICE LOCK	ND50RD SPA	626	SCH
1	EA	DOME STOP	FS436	626	IVE
1	SET	DOOR SEALS	SUPPLY WITH DOOR AND FRAME ASSEMBLY		
1	EA	SILL	PER DETAIL	628	

HW SET: 05 INTERIOR PAIR / ALUMINUM STOREFRONT / ACCESS CONTROL / MAGNETIC HOLD-OPEN
DOOR NUMBER:
110 130

EACH TO HAVE:

1	EA	POWER TRANSFER	EPT-10	689	VON
1	EA	CONTINUOUS HINGE	112HD	628	IVE
1	EA	CONTINUOUS HINGE	112HD EPT	628	IVE
1	EA	PANIC HARDWARE	CD9947EO	626	VON
1	EA	ELEC TRIM PANIC	CD9947L X E996L X 17	626	VON
1	EA	RIM CYLINDER	20-757 (PRIMUS IC CORE RIM CYLINDER)	613	SCH
2	EA	MORTISE CYLINDER	20-771 X XQ11-948 (FOR CD DOGGING)	626	SCH
2	EA	SURFACE CLOSER	4041 X 18G MTG PLATE (TOP JAMB MOUNTED)	689	LCN
2	EA	FLOOR STOP	FS444	626	IVE
2	EA	MAGNETIC HOLD-OPEN	SEM 7830	AL	LCN
1	EA	CARD READER	PROVIDED UNDER DIVISION 28 1300		
2	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	POWER SUPPLY	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		

NOTE: THIS OPENING HAS ELECTRIFIED TRIM

HW SET: 06 EXTERIOR PAIR / ALUMINUM STOREFRONT / ACCESS CONTROL / CARD READER
DOOR NUMBER:
111

EACH TO HAVE:

2	EA	POWER TRANSFER	EPT-10	689	VON
2	EA	CONTINUOUS HINGE	112HD EPT	628	IVE
2	EA	DOGGED EL DEVICE	SD-EL9947NL X 990NL	626	VON
2	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
2	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
2	EA	MORTISE CYLINDER	20-771 (FOR SD DOGGING)	626	SCH
2	EA	SURFACE CLOSER	4041 X 18G MTG PLATE (TOP JAMB MOUNTED)	689	LCN
2	EA	OVERHEAD STOP	100S	630	GLY
1	SET	WEATHER SEAL	SUPPLY WITH DOOR AND FRAME ASSEMBLY		
2	EA	DOOR SWEEP	SUPPLY WITH DOOR AND FRAME ASSEMBLY		
1	EA	THRESHOLD	PER DETAIL	628	
1	EA	POWER SUPPLY	PS873-2	GRY	VON
1	EA	CARD READER	PROVIDED UNDER DIVISION 28 1300		
2	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		

HW SET: 06A INTERIOR PAIR / ALUMINUM STOREFRONT / ACCESS CONTROL
DOOR NUMBER:
225.1 227.1

EACH TO HAVE:

2	EA	POWER TRANSFER	EPT-10	689	VON
2	EA	CONTINUOUS HINGE	112HD EPT	628	IVE
1	EA	PANIC HARDWARE	EL9947DT X 990DT	626	VON
1	EA	PANIC HARDWARE	EL9947NL X 990NL	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
2	EA	SURFACE CLOSER	4041 X 18G MTG PLATE (TOP JAMB MOUNTED)	689	LCN
2	EA	FLOOR STOP	FS444	626	IVE
1	SET	WEATHER SEAL	SUPPLY WITH DOOR AND FRAME ASSEMBLY		
1	EA	THRESHOLD	PER DETAIL	628	
1	EA	POWER SUPPLY	PS873-2	GRY	VON
2	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		

NOTE: THIS IS A SCHEDULED LOCK AND UNLOCK OPENING.

HW SET: 06B INTERIOR PAIR / ALUMINUM STOREFRONT / ACCESS CONTROL / CARD READER
DOOR NUMBER:
225.2

EACH TO HAVE:

2	EA	POWER TRANSFER	EPT-10	689	VON
2	EA	CONTINUOUS HINGE	112HD EPT	628	IVE
1	EA	DOGGED EL DEVICE	SD-EL9947NL X 990NL	626	VON
1	EA	PANIC HARDWARE	EL9947DT X 990DT	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
2	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	MORTISE CYLINDER	20-771 (FOR SD DOGGING)	626	SCH
2	EA	SURFACE CLOSER	4041 X 18G MTG PLATE (TOP JAMB MOUNTED)	689	LCN
2	EA	FLOOR STOP	FS444	626	IVE
1	SET	WEATHER SEAL	SUPPLY WITH DOOR AND FRAME ASSEMBLY		
1	EA	THRESHOLD	PER DETAIL	628	
1	EA	POWER SUPPLY	PS873-2	GRY	VON
1	EA	CARD READER	PROVIDED UNDER DIVISION 28 1300		
2	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		

HW SET: 06C EXTERIOR PAIR / ALUMINUM SF / ACCESS CONTROL / CARD READER / AUTO OPERATOR
DOOR NUMBER:
280.1

EACH TO HAVE:

2	EA	POWER TRANSFER	EPT-10	689	VON
2	EA	CONTINUOUS HINGE	112HD EPT	628	IVE
2	EA	DOGGED EL DEVICE	SD-EL9947NL X 990NL	626	VON
2	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
2	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
2	EA	MORTISE CYLINDER	20-771 (FOR SD DOGGING)	626	SCH
1	EA	SURFACE CLOSER	4041 X 18G MTG PLATE (TOP JAMB MOUNTED)	689	LCN
1	EA	AUTO-EQUALIZER	4642	689	LCN
2	EA	OVERHEAD STOP	100S	630	GLY
1	SET	WEATHER SEAL	SUPPLY WITH DOOR AND FRAME ASSEMBLY		
2	EA	DOOR SWEEP	SUPPLY WITH DOOR AND FRAME ASSEMBLY		
1	EA	THRESHOLD	PER DETAIL	628	
1	EA	POWER SUPPLY	PS873 X 2 X AO	GRY	VON
1	EA	CARD READER	PROVIDED UNDER DIVISION 28 1300		
2	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		
2	EA	ACTUATOR, WALL MOUNT	8310-856		LCN
2	EA	ESCUTCHEON	8310-874	630	LCN

NOTE: THIS OPENING HAS AN AUTO OPERATOR AT THE RHR LEAF. CLARIFICATION- THE RX MOTION DETECTOR IS A REQUEST TO EXIT TO KILL THE ALARM ONLY AND DOES NOT OPERATE THE AUTO OPERATOR.

HW SET: 06D EXTERIOR PAIR / ALUMINUM STOREFRONT / ACCESS CONTROL
DOOR NUMBER:
280.2

EACH TO HAVE:

2	EA	POWER TRANSFER	EPT-10	689	VON
2	EA	CONTINUOUS HINGE	112HD EPT	628	IVE
1	EA	PANIC HARDWARE	EL9947DT X 990DT	626	VON
1	EA	PANIC HARDWARE	EL9947NL X 990NL	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
2	EA	SURFACE CLOSER	4041 X 18G MTG PLATE (TOP JAMB MOUNTED)	689	LCN
2	EA	OVERHEAD STOP	100S	630	GLY
1	SET	WEATHER SEAL	SUPPLY WITH DOOR AND FRAME ASSEMBLY		
1	EA	THRESHOLD	PER DETAIL	628	
1	EA	POWER SUPPLY	PS873-2	GRY	VON
2	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		

NOTE: THIS OPENING IS A SCHEDULED LOCK AND UNLOCK OPENING.

HW SET: 07 INTERIOR / STORAGE
DOOR NUMBER:
112 206.2 305 327

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD SPA	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	DOME STOP	FS436	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 07A INTERIOR / CLASSROOM STORAGE, FILE ROOM
DOOR NUMBER:
232.2 303 314 342 359.7 361.3
361.6

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80RD SPA	626	SCH
1	EA	DOME STOP	FS436	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 08 INTERIOR / RATED / CORRIDOR, CLASSROOM
DOOR NUMBER:
113

EACH TO HAVE:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	ND70RD SPA	626	SCH
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
1	SET	GASKET	PER SELECTED DOOR MFGR		

HW SET: 09 INTERIOR / RATED / ELEC, ELEV,
DOOR NUMBER:
114 116 133 203 260 308

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD SPA	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	SURFACE CLOSER	4041	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
1	SET	SEALS	2525B	BRN	NGP

HW SET: 09A INTERIOR / RATED / MECH
DOOR NUMBER:
123.3 228 317

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD SPA	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	SURFACE CLOSER	4041	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
1	SET	GASKET	PER SELECTED DOOR MFGR		

HW SET: 10 INTERIOR / RATED / FACILITIES & MAINT OP
DOOR NUMBER:
117 119

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE LOCK	ND50TD SPA	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	SURFACE CLOSER	4041	689	LCN
1	EA	DOME STOP	FS436	626	IVE
1	SET	GASKET	PER SELECTED DOOR MFGR		

HW SET: 10A INTERIOR / FACILITIES & MAINT OP
DOOR NUMBER:
137 224 351 354

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE LOCK	ND50TD SPA	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	SURFACE CLOSER	4041	689	LCN
1	EA	DOME STOP	FS436	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 11 INTERIOR / RATED / TRANSFORMER
DOOR NUMBER:
121.1

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80TD SPA	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
1	SET	SEALS	2525B	BRN	NGP

HW SET: 11A INTERIOR / RATED / FIRE RISER ROOM
DOOR NUMBER:
140.1 252 384

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80TD SPA	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	DOME STOP	FS436	626	IVE
1	SET	GASKET	PER SELECTED DOOR MFGR		

HW SET: 11B INTERIOR / STORGE
DOOR NUMBER:
142.5

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80TD SPA	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	OVERHEAD STOP	100S	630	GLY
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 12 INTERIOR PAIR / RATED / TRANSFORMER
DOOR NUMBER:
121.2

EACH TO HAVE:

6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	MANUAL FLUSH BOLT	FB457	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80TD SPA 14-042	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	ASTRAGAL	139SP / OR BY DOOR MFG	600	NGP
1	EA	SURFACE CLOSER	4041 PA @ ACTIVE LEAF	689	LCN
1	SET	SEALS	2525B	BRN	NGP

HW SET: 12A INTERIOR PAIR / RATED / ELEC
DOOR NUMBER:
140.2 254 386

EACH TO HAVE:

6	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
2	EA	MANUAL FLUSH BOLT	FB358	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80TD SPA 14-042	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	SURFACE CLOSER	4041 PA @ ACTIVE LEAF	689	LCN
1	SET	GASKET	PER SELECTED DOOR MFGR		

HW SET: 12B INTERIOR PAIR / STORAGE
DOOR NUMBER:
140.3 140.4 140.5 234.3

EACH TO HAVE:

6	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
2	EA	MANUAL FLUSH BOLT	FB358	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80RD SPA	626	SCH
2	EA	DOME STOP	FS436	626	IVE
2	EA	SILENCER	SR64	GRY	IVE

HW SET: 12C INTERIOR PAIR / YOGA STORAGE
DOOR NUMBER:
236.2 236.3

EACH TO HAVE:

6	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
2	EA	MANUAL FLUSH BOLT	FB358	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80RD SPA	626	SCH
2	EA	DOME STOP	FS436	626	IVE
2	EA	SILENCER	SR64	GRY	IVE

HW SET: 13 OVERHEAD COILING DOOR / CARD READER
DOOR NUMBER:
123.1

EACH TO HAVE:

1	SET		BALANCE OF HARDWARE BY DOOR MFG	
1	EA	CARD READER	PROVIDED UNDER DIVISION 28 1300	
1	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300	
1	EA	CYLINDER	TO MATCH DISTRICT STANDARD	SCH

HW SET: 13A OVERHEAD COILING DOOR
DOOR NUMBER:
202.2 202.3

EACH TO HAVE:

1	SET		BALANCE OF HARDWARE BY DOOR MFG	
1	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300	
1	EA	CYLINDER	TO MATCH DISTRICT STANDARD	SCH

HW SET: 13B OVERHEAD COILING DOOR
DOOR NUMBER:
225.4

EACH TO HAVE:

1	SET		BALANCE OF HARDWARE BY DOOR MFG	
1	EA	CYLINDER	TO MATCH DISTRICT STANDARD	SCH

HW SET: 14 INTERIOR / RATED / CORRIDOR
DOOR NUMBER:
123.2

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70RD SPA	626	SCH
1	EA	SURFACE CLOSER	4041	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
1	SET	GASKET	PER SELECTED DOOR MFGR		
1	EA	THRESHOLD	PER DETAIL	628	

HW SET: 15 EXTERIOR / LOCKER ROOM / ACCESS CONTROL
DOOR NUMBER:
131.1 135.1

EACH TO HAVE:

1	EA	POWER TRANSFER	EPT-10	689	VON
1	EA	CONTINUOUS HINGE	112HD EPT	628	IVE
1	EA	PANIC HARDWARE	99L E996L X 17 X FSE X LD (LESS DOGGING)	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	FLOOR STOP	FS444	626	IVE
1	SET	SEALS	2525B	BRN	NGP
1	EA	DOOR SWEEP	200NA 36"	AL	NGP
1	EA	THRESHOLD	PER DETAIL	628	
1	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	POWER SUPPLY	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		

NOTE: THIS OPENING HAS ELECTRIFIED TRIM. IT IS A SCHEDULED LOCK AND UNLOCK OPENING.

HW SET: 16 INTERIOR / CHANGING ROOM, ADAPTED LOCKERS
DOOR NUMBER:
131.2 134 135.2 142.6 227.2 310

EACH TO HAVE:

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70RD SPA	626	SCH
1	EA	SURFACE CLOSER	4041	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	WALL STOP	WS402CCV	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 16A INTERIOR / DENTAL LAB / ACCESS CONTROL

DOOR NUMBER:
325.1

EACH TO HAVE:

2	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW4	652	IVE
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	EU STOREROOM LOCK	ND80TDEU SPA	626	SCH
1	EA	SURFACE CLOSER	4041	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	POWER SUPPLY	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		

NOTE: THIS IS A SCHEDULED LOCK AND UNLOCK OPENING

HW SET: 16B INTERIOR / DENTAL LAB / ACCESS CONTROL / CARD READER
DOOR NUMBER:
325.2

EACH TO HAVE:

2	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW4	652	IVE
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	EU STOREROOM LOCK	ND80TDEU SPA	626	SCH
1	EA	SURFACE CLOSER	4041	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	CARD READER	PROVIDED UNDER DIVISION 28 1300		
1	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	POWER SUPPLY	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		

HW SET: 17 INTERIOR / ADAPTED ASSESS.
DOOR NUMBER:
141.1 141.2 208

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE LOCK	ND50RD SPA	626	SCH
1	EA	DOME STOP	FS436	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 18 INTERIOR PAIR / ALUMINUM STOREFRONT
DOOR NUMBER:
142.1

EACH TO HAVE:

2	SET	PIVOT SET	7215	626	IVE
2	EA	PIVOT	7215 INT	626	IVE
1	SET	HEAD/THRESHOLD BOLT	4015 X 4085	603	ADA
1	EA	MORTISE THUMBTURN	4066	628	ADA
1	EA	DEADLOCK	MS1850S	628	ADA
1	EA	MORTISE CYLINDER	20-062 (FOR MS LOCK)	626	SCH
1	EA	EXIT INDICATOR	4089	628	ADA
1	EA	CYLINDER GUARD	MS4043-01 1/4"	603	ADA
2	EA	PULL/PUSHBAR	9190-0	630	IVE
2	EA	SURFACE CLOSER	4021 X 18G (TOP JAMB MOUNTED)	689	LCN
2	EA	DOME STOP	FS436	626	IVE
1	SET	DOOR SEALS	SUPPLY WITH DOOR AND FRAME ASSEMBLY		
1	EA	SILL	PER DETAIL	628	

HW SET: 19 EXTERIOR / ACCESS CONTROL / CARD READER
DOOR NUMBER:
142.4

EACH TO HAVE:

1	EA	POWER TRANSFER	EPT-10	689	VON
1	EA	CONTINUOUS HINGE	112HD EPT	628	IVE
1	EA	PANIC HARDWARE	99L E996L X 17 X FSE X LD (LESS DOGGING)	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	FLOOR STOP	FS444	626	IVE
1	SET	SEALS	2525B	BRN	NGP
1	EA	DOOR SWEEP	200NA 36"	AL	NGP
1	EA	THRESHOLD	PER DETAIL	628	
1	EA	CARD READER	PROVIDED UNDER DIVISION 28 1300		
1	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	POWER SUPPLY	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		

NOTE: THIS OPENING HAS ELECTRIFIED TRIM.

HW SET: 19A EXTERIOR / ACCESS CONTROL
DOOR NUMBER:
142.7

EACH TO HAVE:

1	EA	POWER TRANSFER	EPT-10	689	VON
1	EA	CONTINUOUS HINGE	112HD EPT	628	IVE
1	EA	PANIC HARDWARE	99L E996L X 17 X FSE X LD (LESS DOGGING)	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	FLOOR STOP	FS444	626	IVE
1	SET	SEALS	2525B	BRN	NGP
1	EA	DOOR SWEEP	200NA 36"	AL	NGP
1	EA	THRESHOLD	PER DETAIL	628	
1	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	POWER SUPPLY	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		

NOTE: THIS OPENING HAS ELECTRIFIED TRIM. IT IS A SCHEDULED LOCK AND UNLOCK OPENING.

HW SET: 20 INTERIOR / RATED / STAIR / MAG HOLD-OPEN
DOOR NUMBER:
S13.1

EACH TO HAVE:

3	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	FIRE EXIT HARDWARE	99L-F 996L X 17	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	CORE ONLY	23-030 (CLASSIC F)	626	SCH
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	FLOOR STOP	FS444	626	IVE
1	EA	MAGNETIC HOLD-OPEN	SEM 7830	AL	LCN
1	SET	GASKET	PER SELECTED DOOR MFGR		

HW SET: 21 INTERIOR PAIR / RATED / MAG HOLD-OPEN
DOOR NUMBER:
S21.2 S23.1

EACH TO HAVE:

6	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	FIRE EXIT HARDWARE	9927EO-F-LBR	626	VON
1	EA	FIRE EXIT HARDWARE	9927L-F-LBR 996L X 17	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	CORE ONLY	23-030 (CLASSIC F)	626	SCH
2	EA	SURFACE CLOSER	4041 EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
2	EA	FLOOR STOP	FS444	626	IVE
2	EA	MAGNETIC HOLD-OPEN	SEM 7830	AL	LCN
1	SET	GASKET	PER SELECTED DOOR MFGR		

HW SET: 21A INTERIOR PAIR / RATED / MAG HOLD-OPEN
DOOR NUMBER:
S13.2

EACH TO HAVE:

8	EA	HINGE	5BB1HW 5 X 4.5 NRP	652	IVE
1	EA	FIRE EXIT HARDWARE	9927EO-F-LBR	626	VON
1	EA	FIRE EXIT HARDWARE	9927L-F-LBR 996L X 17	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	CORE ONLY	23-030 (CLASSIC F)	626	SCH
2	EA	SURFACE CLOSER	4041 EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
2	EA	FLOOR STOP	FS444	626	IVE
2	EA	MAGNETIC HOLD-OPEN	SEM 7830	AL	LCN
1	SET	GASKET	PER SELECTED DOOR MFGR		

HW SET: 22 EXTERIOR / STAIR / ACCESS CONTROL / LOCAL ALARM
DOOR NUMBER:
S13.3 S14.2

EACH TO HAVE:

1	EA	POWER TRANSFER	EPT-2	689	VON
1	EA	CONTINUOUS HINGE	112HD EPT	628	IVE
1	EA	PANIC HARDWARE	SS99EO (EMERG EXIT ONLY-ALARM WILL SOUND)	626	VON
1	EA	MORTISE CYLINDER	20-771 (PRIMUS FOR SS DEVICE)	626	SCH
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	FLOOR STOP	FS444	626	IVE
1	SET	SEALS	2525B	BRN	NGP
1	EA	DOOR SWEEP	200NA 36"	AL	NGP
1	EA	THRESHOLD	PER DETAIL	628	
1	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	POWER SUPPLY	PROVIDED UNDER DIVISION 28 1300		
1	EA	ELECTRONIC HORN	1910-1	WHT	SCE

HW SET: 23 INTERIOR / RATED / ACCESS CONTROL / LOCAL ALARM
DOOR NUMBER:
S14.1 S14.3

EACH TO HAVE:

2	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	652	IVE
1	EA	FIRE EXIT HARDWARE	SS99EO-F (EMER EXIT ONLY-ALARM WILL SOUND)	626	VON
1	EA	MORTISE CYLINDER	20-771 (PRIMUS FOR SS DEVICE)	626	SCH
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	FLOOR STOP	FS444	626	IVE
1	SET	GASKET	PER SELECTED DOOR MFGR		
1	EA	THRESHOLD	PER DETAIL	628	
1	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	POWER SUPPLY	PROVIDED UNDER DIVISION 28 1300		
1	EA	ELECTRONIC HORN	1910-1	WHT	SCE

HW SET: 23A INTERIOR / RATED / ACCESS CONTROL / LOCAL ALARM
DOOR NUMBER:
S23.2 S24.1 S24.2 S33 S34.1 S34.2

EACH TO HAVE:

2	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	652	IVE
1	EA	PANIC HARDWARE	SS99L-F X E996L X 17 X FS (FAIL SAFE)	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	MORTISE CYLINDER	20-771 (PRIMUS FOR SS DEVICE)	626	SCH
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	FLOOR STOP	FS444	626	IVE
1	SET	GASKET	PER SELECTED DOOR MFGR		
1	EA	THRESHOLD	PER DETAIL	628	
1	EA	POWER SUPPLY	PS873-FA	GRY	VON
1	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	ELECTRONIC HORN	1910-1	WHT	SCE

NOTE: THIS OPENING HAS AN ALARMED EXIT DEVICE WITH FAIL-SAFE, ELECTRIFIED, PULL-SIDE TRIM (E996L). THIS DEVICE MUST BE TIED INTO THE FIRE ALARM FOR ACCESS FROM THE STAIR WELL. IN THE EVENT OF A FIRE ALARM OR LOSS OF POWER THE OUTSIDE TRIM IS UNLOCKED.

HW SET: 24 INTERIOR / CONCESSION / KEYPAD
DOOR NUMBER:
202.1

EACH TO HAVE:

2	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW4	652	IVE
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	EU STOREROOM LOCK	ND80TDEU SPA	626	SCH
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	KEY PAD	PROVIDED UNDER DIVISION 28 1300		
1	EA	POWER SUPPLY	PROVIDED UNDER DIVISION 28 1300		

HW SET: 25 INTERIOR / CLASSROOM, STERILIZATION
DOOR NUMBER:
206.1 311.1

EACH TO HAVE:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	ND70RD SPA	626	SCH
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 25A INTERIOR / STERILIZATION
DOOR NUMBER:
311.2 359.3

EACH TO HAVE:

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70RD SPA	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 26 INTERIOR / CHANGING
DOOR NUMBER:
206.3 221

EACH TO HAVE:

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PRIVACY SET	ND40S SPA	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 27 INTERIOR / RECEPTION
DOOR NUMBER:
222.1

EACH TO HAVE:

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70RD SPA	626	SCH
1	EA	DOME STOP	FS436	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 28 INTERIOR / RATED / DISPENSARY
DOOR NUMBER:
225.3

EACH TO HAVE:

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD SPA	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	SURFACE CLOSER	4041	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
1	SET	GASKET	PER SELECTED DOOR MFGR		

HW SET: 29 INTERIOR / CORRIDOR / ALARM
DOOR NUMBER:
230 309.2

EACH TO HAVE:

2	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	652	IVE
1	EA	PANIC HARDWARE	SS99L X E996L X 17 X FS (FAIL SAFE)	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	MORTISE CYLINDER	20-771 (PRIMUS FOR SS DEVICE)	626	SCH
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	FLOOR STOP	FS444	626	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	POWER SUPPLY	PS873-FA	GRY	VON
1	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	ELECTRONIC HORN	1910-1	WHT	SCE

NOTE: THIS OPENING HAS AN ALARMED EXIT DEVICE WITH FAIL-SAFE, ELECTRIFIED, PULL-SIDE TRIM (E996L). THIS DEVICE MUST BE TIED INTO THE FIRE ALARM FOR ACCESS FROM THE STAIR WELL OR CORRIDOR. IN THE EVENT OF A FIRE ALARM OR LOSS OF POWER THE OUTSIDE TRIM IS UNLOCKED.

HW SET: 30 INTERIOR / SPINNING
DOOR NUMBER:
232.1

EACH TO HAVE:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	PANIC HARDWARE	CD99NL X 990NL	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	MORTISE CYLINDER	20-061T XQ11-948	626	SCH
2	EA	CORE ONLY	23-030 (CLASSIC F)	626	SCH
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	FLOOR STOP	FS444	626	IVE
1	EA	SILL	PER DETAIL	628	
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 30A INTERIOR / ALUM STOREFRONT / EXERCISE
DOOR NUMBER:
234.1

EACH TO HAVE:

1	EA	CONTINUOUS HINGE	112HD	628	IVE
1	EA	PANIC HARDWARE	CD99NL X 990NL	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	MORTISE CYLINDER	20-061T XQ11-948	626	SCH
2	EA	CORE ONLY	23-030 (CLASSIC F)	626	SCH
1	EA	SURFACE CLOSER	4041 X 18G MTG PLATE (TOP JAMB MOUNTED)	689	LCN
1	EA	FLOOR STOP	FS444	626	IVE
1	SET	DOOR SEALS	SUPPLY WITH DOOR AND FRAME ASSEMBLY		
1	EA	SILL	PER DETAIL	628	

HW SET: 31 INTERIOR PAIR / YOGA
DOOR NUMBER:
236.1 238

EACH TO HAVE:

6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	CD9927DT-LBR	626	VON
1	EA	PANIC HARDWARE	CD9927NL-LBR	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
2	EA	MORTISE CYLINDER	20-061T XQ11-948	626	SCH
3	EA	CORE ONLY	23-030 (CLASSIC F)	626	SCH
2	EA	SURFACE CLOSER	4041 EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
2	EA	FLOOR STOP	FS444	626	IVE
1	EA	SILL	PER DETAIL	628	

HW SET: 32 INTERIOR PAIR / RATED
DOOR NUMBER:
270 390

EACH TO HAVE:

6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	FIRE EXIT HARDWARE	9927EO-F-LBR	626	VON
1	EA	FIRE EXIT HARDWARE	9927L-F-LBR 996L X 17	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	CORE ONLY	23-030 (CLASSIC F)	626	SCH
2	EA	SURFACE CLOSER	4041 EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
2	EA	FLOOR STOP	FS444	626	IVE
1	SET	GASKET	PER SELECTED DOOR MFGR		
1	EA	SILL	PER DETAIL	628	

HW SET: 33 EXTERIOR PAIR / ALUMINUM STOREFRONT / DOOR CONTACT AND RX ONLY
DOOR NUMBER:
S21.1

EACH TO HAVE:

2	EA	CONTINUOUS HINGE	112HD	628	IVE
1	EA	PANIC HARDWARE	CD9947DT	626	VON
1	EA	PANIC HARDWARE	CD9947NL	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
2	EA	MORTISE CYLINDER	20-771 X XQ11-948 (FOR CD DOGGING)	626	SCH
2	EA	SURFACE CLOSER	4021 X 18G (TOP JAMB MOUNTED)	689	LCN
2	EA	OVERHEAD STOP	100S	630	GLY
1	SET	WEATHER SEAL	SUPPLY WITH DOOR AND FRAME ASSEMBLY		
2	EA	DOOR SWEEP	SUPPLY WITH DOOR AND FRAME ASSEMBLY		
1	EA	THRESHOLD	PER DETAIL	628	
2	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		

NOTE: THIS IS A MONITORED DOOR WITH AUTHORIZED EXITING.

HW SET: 34 INTERIOR / STAIR
DOOR NUMBER:
S23.3

EACH TO HAVE:

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PANIC HARDWARE	99L-BE X 996L-BE X 17	626	VON
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	FLOOR STOP	FS444	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 35 INTERIOR PAIR / ALUMINUM STOREFRONT / STUDENT LOUNGE
DOOR NUMBER:
309.1

EACH TO HAVE:

2	EA	CONTINUOUS HINGE	112HD	628	IVE
1	EA	PANIC HARDWARE	CD9947DT	626	VON
1	EA	PANIC HARDWARE	CD9947NL	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
2	EA	MORTISE CYLINDER	20-061T XQ11-948	626	SCH
3	EA	CORE ONLY	23-030 (CLASSIC F)	626	SCH
2	EA	SURFACE CLOSER	4021 X 18G (TOP JAMB MOUNTED)	689	LCN
2	EA	FLOOR STOP	FS444	626	IVE
2	EA	DOOR SWEEP	SUPPLY WITH DOOR AND FRAME ASSEMBLY		
1	EA	THRESHOLD	PER DETAIL	628	

HW SET: 36 EXTERIOR / ALUM STOERFRONT / TERRACE / ACCESS CONTROL
DOOR NUMBER:
309.3

EACH TO HAVE:

1	SET	PIVOT SET	7215	626	IVE
1	EA	POWER TRANSF PIVOT	7215PT INT	626	IVE
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	EU STOREROOM LOCK	ND80TDEU SPA	626	SCH
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	FLOOR STOP	FS444	626	IVE
1	SET	WEATHER SEAL	SUPPLY WITH DOOR AND FRAME ASSEMBLY		
1	EA	DOOR SWEEP	SUPPLY WITH DOOR AND FRAME ASSEMBLY		
1	EA	THRESHOLD	PER DETAIL	628	
1	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	POWER SUPPLY	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		

NOTE: THIS IS A SCHEDULED LOCK AND UNLOCK OPENING.

HW SET: 37 INTERIOR / CORRIDOR / ACCESS CONTROL / CARD READER
DOOR NUMBER:
312.1

EACH TO HAVE:

2	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	652	IVE
1	EA	PANIC HARDWARE	99L E996L X 17 FS (FAIL SAFE)	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	FLOOR STOP	FS444	626	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	CARD READER	PROVIDED UNDER DIVISION 28 1300		
1	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	POWER SUPPLY	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		

HW SET: 37A INTERIOR / CORRIDOR / ACCESS CONTROL
DOOR NUMBER:
359.1

EACH TO HAVE:

2	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	652	IVE
1	EA	PANIC HARDWARE	99L E996L X 17 FS (FAIL SAFE)	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	FLOOR STOP	FS444	626	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	POWER SUPPLY	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		

HW SET: 37B INTERIOR PAIR / ACCESS CONTROL / CARD READER
DOOR NUMBER:
359.2

EACH TO HAVE:

5	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	652	IVE
1	EA	PANIC HARDWARE	9927EO-LBR	626	VON
1	EA	PANIC HARDWARE	9927L-LBR X E996L X 17	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
2	EA	SURFACE CLOSER	4041 EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
2	EA	FLOOR STOP	FS444	626	IVE
1	EA	CARD READER	PROVIDED UNDER DIVISION 28 1300		
2	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	POWER SUPPLY	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		

HW SET: 37C INTERIOR PAIR / ACCESS CONTROL
DOOR NUMBER:
361.1

EACH TO HAVE:

5	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 TW8	652	IVE
1	EA	PANIC HARDWARE	9927EO-LBR	626	VON
1	EA	PANIC HARDWARE	9927L-LBR X E996L X 17	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
2	EA	SURFACE CLOSER	4041 EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
2	EA	FLOOR STOP	FS444	626	IVE
2	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	POWER SUPPLY	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		

NOTE; THIS IS A SCHEDULED LOCK AND UNLOCK OPENING

HW SET: 38 INTERIOR / ALUMINUM SF / ACCESS CONTROL / CARD READER AND KEYPAD
DOOR NUMBER:
312.2

EACH TO HAVE:

1	EA	POWER TRANSFER	EPT-10	689	VON
1	EA	CONTINUOUS HINGE	112HD EPT	628	IVE
1	EA	PANIC HARDWARE	99L E996L X 17 FS (FAIL SAFE)	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	FLOOR STOP	FS444	626	IVE
1	SET	DOOR SEALS	SUPPLY WITH DOOR AND FRAME ASSEMBLY		
1	EA	THRESHOLD	PER DETAIL	628	
1	EA	CARD READER	PROVIDED UNDER DIVISION 28 1300		
1	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	KEY PAD	PROVIDED UNDER DIVISION 28 1300		
1	EA	POWER SUPPLY	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		

NOTE: THIS OPENING HAS ELECTRIFIED TRIM, CARD READER, AND KEYPAD

HW SET: 39 INTERIOR / LEAD LINED DOOR / RADIOLOGY / ACCESS CONTROL / CARD READER
DOOR NUMBER:
318

EACH TO HAVE:

1	SET	PIVOT SET	7230F	630	IVE
1	EA	PIVOT	7230F INT	630	IVE
1	EA	CLASSROOM LOCK	L9070T 17A (LEAD LINED)	630	SCH
1	EA	PERMANENT CORE	20-740 (PRIMUS)	626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE 24VDC	630	VON
1	EA	SURFACE CLOSER	4041 (LEAD LINED)	689	LCN
1	EA	FLOOR STOP	FS444	626	IVE
1	EA	THRESHOLD	PER DETAIL	628	
1	EA	CARD READER	PROVIDED UNDER DIVISION 28 1300		
1	EA	DOOR CONTACT	PROVIDED UNDER DIVISION 28 1300		
1	EA	POWER SUPPLY	PROVIDED UNDER DIVISION 28 1300		
1	EA	RX MOTION DETECTOR	PROVIDED UNDER DIVISION 28 1300		

NOTE: THIS OPENING HAS AN ELECTRIC STRIKE.

HW SET: 40 INTERIOR / SGL STALL RESTROOM
DOOR NUMBER:
337

EACH TO HAVE:

3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PRIVACY SET	ND40S SPA	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	WALL STOP	WS402CCV	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 41 INTERIOR / RATED / CLASSROOM
DOOR NUMBER:
355.1 357.2

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	FIRE EXIT HARDWARE	99L-F 996L X 17	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	CORE ONLY	23-030 (CLASSIC F)	626	SCH
1	EA	SURFACE CLOSER	4041 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436	626	IVE
1	SET	GASKET	PER SELECTED DOOR MFGR		
1	EA	THRESHOLD	PER DETAIL	628	

HW SET: 41A INTERIOR / RATED / CLASSROOM
DOOR NUMBER:
355.2 357.1

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	FIRE EXIT HARDWARE	99L-F 996L X 17	626	VON
1	EA	IC RIM CYLINDER	20-057T X ICX (CONST CORE)	626	SCH
1	EA	CORE ONLY	23-030 (CLASSIC F)	626	SCH
1	EA	SURFACE CLOSER	4041 SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	SET	GASKET	PER SELECTED DOOR MFGR		
1	EA	THRESHOLD	PER DETAIL	628	

HW SET: 42 INTERIOR / SLIDING GLASS DOORS
DOOR NUMBER:

359B.1	359B.2	359C.1	359C.2	359D.1	359G.1
359G.2	361A.1	361A.2	361D.1	361E.1	361E.2
361F.1	361F.2				

EACH TO HAVE:

1	SET		HARDWARE BY DOOR MFG		

HW SET: 43 INTERIOR / CONTROL
DOOR NUMBER:

359.5	361.4

EACH TO HAVE:

4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70RD SPA	626	SCH
1	EA	DOME STOP	FS436	626	IVE

- END OF SECTION -

- SECTION 08 8000 -

GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Glazed curtain walls.
4. Glazed entrances.
5. Interior borrowed lites.
6. Storefront framing.
7. Spandrel glazing.

1.3 RELATED SECTIONS

A. Section 07 4215 “Glass Façade Panel System”.

B. Section 08 1113 “Hollow Metal Doors & Frames” for vision panels in metal doors.

C. Section 08 1416 “Flush Wood Doors” for vision panels in wood doors.

D. Section 08 1613 “FRP Flush Doors” for vision panels in FRP doors.

E. Section 08 4113 “Aluminum Framed Entrances & Storefronts”.

1.4 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

F. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.5 PERFORMANCE REQUIREMENTS

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

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
   a. Specified Design Wind Loads: As indicated on structural drawings, but not less than wind loads applicable to Project as required by ASCE 7 "Minimum Design Loads for Buildings and Other Structures": Section 6.0 "Wind Loads."
   b. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
      1) Load Duration: 3 seconds.
   c. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch (25 mm), whichever is less.
      1) For monolithic-glass lites heat treated to resist wind loads.
      2) For insulating glass.
      3) For laminated-glass lites.
   d. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
   e. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
   a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F (W/sq. m x K).
   b. Solar Heat Gain Coefficient: NFRC 200.
   c. Solar Optical Properties: NFRC 300.

1.6 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12-inch- (300-mm-) square Samples for glass and of 12-inch- (300-mm-) long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

1. Each color of tinted float glass.
2. Ceramic-coated spandrel glass.
3. Each pattern and color of ceramic-coated vision glass.
4. Fire-resistive glazing products.
5. Insulating glass for each designation indicated.
6. For each color (except black) of exposed glazing sealant indicated.

C. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

D. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

E. Qualification Data: For installers.

F. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

G. Product Test Reports: For each of the following types of glazing products:
   1. Tinted float glass.
   2. Coated float glass.
   3. Insulating glass.
   4. Glazing sealants.
   5. Glazing gaskets.

H. Warranties: Special warranties specified in this Section.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float glass, coated float glass, laminated glass and insulating glass.

C. Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coatings: Where solar-control low-e coatings of a primary glass manufacturer that has established a certified fabricator program is specified, obtain sputter-coated solar-control low-e-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer.

D. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

E. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.
   1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

F. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
   1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
   2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

G. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

H. Glazing for Fire-Rated Window Assemblies: Glazing for assemblies that comply with NFPA 80 and 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 NFPA 257.

I. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.

1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.
2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. (0.84 sq. m) in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. (0.84 sq. m) or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

J. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA Laminated Division's "Laminated Glass Design Guide" and GANA's "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Sloped Glazing Guidelines."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

K. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:

1. Insulating Glass Certification Council.
2. Associated Laboratories, Inc.

L. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F (4.4 deg C).

1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

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

B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to Owner and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

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

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Basis-of-Design Product: The design for each glazing product is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Ultraclear Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I, complying with other requirements specified and with visible light transmission not less than 91 percent.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. AFG Industries, Inc.; Krystal Klear.
   b. Guardian Industries Corp.; Ultrawhite.
   c. Pilkington North America; Optiwhite.
   d. PPG Industries, Inc.; Starphire.

C. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
3. For uncoated glass, comply with requirements for Condition A.
4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.

D. Ceramic-Coated Vision Glass: Float glass with ceramic enamel applied by silk-screened process and complying with ASTM C 1048, Condition C (other coated glass), Type I (transparent flat glass), Quality-Q3, Specification No. 95-1-31 in GANA Tempering Division's "Engineering Standards Manual," and other requirements specified.

E. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B (spandrel glass, one surface ceramic coated), Type I (transparent flat glass), Quality-Q3, and complying with other requirements specified.

1. Basis-of-Design Product: Subject to compliance with requirements, provide ceramic-coated spandrel glass by Northwestern Industries or comparable product by one of the following:
   a. Oldcastle Glass, Inc
   b. Viracon.
2. Glass: Clear float.
3. Ceramic Coating Color: White.
4. Fallout Resistance: Provide spandrel units identical to those passing the fallout-resistance test for spandrel glass specified in ASTM C 1048.

F. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum deposition process after manufacture and heat treatment (if any), and complying with other requirements specified.

G. Silicone-Coated Spandrel Glass: ASTM C 1048, Condition C, Type I, Quality-Q3, and complying with other requirements specified.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Opaci-Coat 300 manufactured by Industrial Control Development, Inc, 13911 NW Third Court, Suite 100, Vancouver, WA, tel: (360) 546-2286, www.icdcoatings.com. or comparable product by one of the following:
2. Glass: Ultraclear float.
3. Silicone Coating Color: Custom colors as selected by Architect.

H. Laminated Glass: ASTM C 1172, and complying with other requirements specified and with the following:

1. Interlayer: Polyvinyl butyral of thickness indicated with a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after laminating glass lites and installation.
   a. For polyvinyl butyral interlayers, laminate lites in autoclave with heat plus pressure.
2. Laminating Process: Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets.

I. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.

1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.
3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
4. Sealing System: Dual seal, with primary and secondary sealants as follows:
   a. Manufacturer's standard sealants.
5. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
   a. Spacer Material: Warm Edge; aluminum with mill or clear anodic finish
      1) Stainless steel if required based on size of unit

2.3 GLAZING GASKETS (DRY)

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. Neoprene, ASTM C 864.
2. EPDM, ASTM C 864.
3. Silicone, ASTM C 1115.
4. Thermoplastic polyolefin rubber, ASTM C 1115.
5. Any material indicated above as recommended by manufacture.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
   1. Neoprene.
   2. EPDM.
   3. Silicone.
   4. Thermoplastic polyolefin rubber.
   5. Any material indicated above as recommended by manufacture.

C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.4 GLAZING SEALANTS (WET)

A. General: Provide products of type indicated, complying with the following requirements:
   1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will 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. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
   1. Single-Component Neutral-Curing Silicone Glazing Sealants GS-1:
      a. Available Products:
         1) GE Silicones; SilPruf SCS2000.
         2) Pecora Corporation; 864.
         3) Pecora Corporation; 890.
         4) Polymeric Systems Inc.; PSI-641.
         5) Sonneborn, Div. of ChemRex, Inc.; Omniseal.
         6) Tremco; Spectrem 3.
      b. Type and Grade: S (single component) and NS (nonsag).
      c. Class: 50.
      d. Use Related to Exposure: NT (nontraffic).
      e. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.
         1) Use O Glazing Substrates: Coated glass color anodic aluminum aluminum coated with a high-performance coating galvanized steel and wood.

f. Applications: Vertical glazing applications as recommended by manufacture where wet seal is preferred over gaskets.

C. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

2.5 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; 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; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. 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; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:

1. Type 1, for glazing applications in which tape acts as the primary sealant.
2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.

C. Grind smooth and polish glass edges and corners, where exposed.

2.8 MONOLITHIC FLOAT-GLASS UNITS

A. Uncoated Clear Float-Glass Units:

1. Class 1 (clear) annealed or Kind HS (heat-strengthened) float glass where heat strengthening is required to resist thermal stresses induced by differential shading of individual glass lites and to comply with system performance requirements
   a. Kind FT (fully tempered) float glass as indicated on drawings.
   b. Thickness: 6.0 mm.

B. Glass Type: Ceramic-coated spandrel glass, fully tempered float glass.

1. Thickness: 6.0 mm.
2. Coating Location: Second surface.

2.9 FIRE-RATED GLAZING PRODUCTS

A. Laminated Ceramic Glazing Material: Proprietary Category II safety glazing product in the form of 2 lites of clear ceramic glazing material laminated together to produce a laminated lite of 5/16-inch (8-mm) nominal thickness; polished on both surfaces; weighing 4 lb/sq. ft. (19.5 kg/sq. m); and as follows:

1. Fire-Protection Rating: As indicated for the assembly in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
   a. Polished on both surfaces, transparent.
   b. Product: "FireLite Plus" by Nippon Electric Glass Co., Ltd., and distributed by Technical Glass Products.
      1) Overall Unit Thickness: 28.6 mm.
      2) Interspace Content: Air, 1/2-inch (13.2 mm)

2.10 INSULATING-GLASS UNITS

A. Solar-Control Low-E Insulating-Glass Units:

1. Basis-of-Design Product: PPG Lo E2 – Solarban 60 Spectrally Selective-Sputter Coating or a comparable product by one of the following:
   a. AFG Industries; Titanium-AC
   b. Cardinal Lo E^2 –171/172

c. Pilkington Building Products North America; Activ.
d. Guardian Industries; Performance Plus II

2. Overall Unit Thickness and Thickness of Each Lite: 1-inch and 1/4 inch.
3. Interspace Content: Air with 1/2 thick “Warm Edge” spacer.
4. Outdoor Lite: Class 1 (tinted) float glass; PPG Clear
   a. Kind FT (fully tempered).
5. Indoor Lite: Class 1 (clear) float glass.
6. Low-E Coating: Sputtered on second surface.
7. Reflective Coating: Sputtered.
8. Visible Light Transmittance: 70 percent minimum.
9. Winter Nighttime U-Factor: 0.29 maximum.
10. Summer Daytime U-Factor: 0.28 maximum.
11. Solar Heat Gain Coefficient: 0.38 maximum.
12. Shading Coefficient: 0.44 percent maximum.

B. Ceramic-Coated Radiant Low-E Spandrel Insulating-Glass Units:
1. Basis-of-Design Product: Viraspan Ceramic Frit, as manufactured by Viracon, Otatonna, MN., tel: (800) 533-0280, www.viracon.com.
2. Overall Unit Thickness: 25.4 mm.
3. Total Thickness of Inner Lite: 6.0 mm.
   a. Indoor Lite: Ceramic-coated spandrel glass
      1) Kind HS (heat strengthened).
      2) Frit: Standard color ceramic frit, fourth surface
4. Thickness of Outer Lite: 6.0 mm.
5. Outdoor Lite: Class 2 (tinted) float glass.
   a. Tint Color: As selected by Architect.
   b. Kind HS (heat strengthened), unless otherwise indicated.
6. Interspace Content: 1/2-inch (13.2 mm), Air.
7. Low-E Coating: Sputtered on second surface.
8. Winter Nighttime U-Factor: 0.30 Btu/(hr x sqft x degrees F) maximum.
9. Summer Daytime U-Factor: 0.26 Btu/(hr x sqft x degrees F) maximum.
10. Indoor Lite:
    a. Ceramic Coating Location: Fourth surface.
11. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:
1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.

3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 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. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. 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.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm) as follows:
1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. 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.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 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 and then to jambs. Cover horizontal framing joints by applying tapes to jambs and 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. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. 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.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in 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. 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. Install gaskets so they protrude past face of glazing stops.

3.6 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.

3.7 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.8 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

- END OF SECTION -

- SECTION 08 8300 -

MIRRORS

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. Unframed tempered glass mirrors qualifying as safety glazing in restrooms and fitness room.

1.3 RELATED DOCUMENTS

A. Section 08 8000 “Glazing” for glass with reflective coatings used for vision and spandrel lites.

B. Section 10 2800 "Toilet and Bath Accessories" for metal-framed mirrors.

1.4 DEFINITIONS

A. Deterioration of Mirrors: Defects developed from normal use that are attributable to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning mirrors contrary to mirror manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1.5 PERFORMANCE REQUIREMENTS

A. Provide mirrors that will not fail under normal usage. Failure includes glass breakage and deterioration attributable to defective manufacture, fabrication, and installation.

1.6 SUBMITTALS

A. Product Data: For the following:

1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
2. Mirror mastic.
3. Mirror hardware.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.

C. Samples: For each type of mirror product required, in the form indicated below:
   1. Mirrors, 12 inches (300 mm) square, including edge treatment on 2 adjoining edges.
   2. Mirror trim, 12 inches (300 mm) long.

D. Product Certificates: For each type of mirror and mirror mastic, signed by product manufacturer.

E. Qualification Data: For Installer.

F. Mirror Mastic Compatibility Test Reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing and substrates on which mirrors are installed.

G. Warranty: Special warranty specified in this Section.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed mirror glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in mirror installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under NGA's Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

B. Source Limitations for Mirrors: Obtain mirrors from one source for each type of mirror indicated.

C. Source Limitations for Mirror Glazing Accessories: Obtain mirror glazing accessories from one source for each type of accessory indicated.

D. Glazing Publications: Comply with the following published recommendations:
   1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
   2. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

E. Safety Glazing Products: For laminated mirrors, provide products complying with testing requirements in 16 CFR 1201 for Category II materials.

F. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing paint and substrates on which mirrors are installed.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors, protected from moisture including condensation.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form, made out to Owner and signed by mirror manufacturer agreeing to replace mirrors that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below:
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering mirrors that may be incorporated into the Work include, but are not limited to, the following:
   1. Arch Aluminum & Glass Co., Inc.
   2. Gardner Glass Products.
   3. Gilded Mirrors, Inc.
   4. Guardian Industries Corp.
   5. Lenoir Mirror Company.
   6. Messer Industries, Inc.
   7. Stroupe Mirror Co., Inc.
   8. Sunshine Mirror.
   9. Virginia Mirror Company, Inc.
   10. VVP America, Inc.; Binswanger Mirror Products.

2.2 SILVERED FLAT GLASS MIRROR MATERIALS

A. Tempered Clear Glass Mirrors: Comply with ASTM C 1503, Mirror Glazing Quality, for blemish requirements in annealed float glass before silver coating is applied, for coating requirements, and with other requirements not affected by tempering process; and comply with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied.
   1. Provide mirrors, free from objectionable wave, with safety glass backing complying with CFR Part 1201, Category II and ANSI Z97.1 glazing standards for mirrors extending to within 6-inches of floor, as indicated on Drawings.
   2. Nominal Thickness: 6.0 mm.
   3. Edges: Square and polished.

4. Reflective Coating: Manufacturer's standard silver coating followed by electrolytic deposited copper coating and 2 separate coats of protective paint.

2.3 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Type A Shore durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Gunther Mirror Mastics.
   b. Palmer Products Corporation.
   c. Pecora Corporation
2. Primers/Sealers: Types recommended by adhesive manufacturer as required.
3. VOC Content: Not more than 100 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MIRROR HARDWARE

A. Top and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.

1. Bottom Trim: J-channels formed with front leg and back leg not less than 5/16 and 3/4 inch (7.9 and 19 mm) in height, respectively.
2. Top Trim: Formed with front leg with a height of 5/16 inch (7.9 mm) and back leg designed to fit into the pocket created by wall-mounted aluminum cleat.
3. Product: Subject to compliance with requirements, provide the following:
   a. Bottom Trim: C. R. Laurence Co., Inc.; D638 FHA Type "J" Channel.
   b. Top Trim: C. R. Laurence Co., Inc.; D 1638 Top Channel.
   c. Cleat: C. R. Laurence Co., Inc.; D 1637M Mirror Mount System Cleat.

B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.5 FABRICATION

A. Mirror Sizes: To suit Project conditions, and before tempering, cut mirrors to final sizes and shapes.

B. Cutouts: Fabricate cutouts before tempering for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance.
   1. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
   2. Proceed with mirror installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating surfaces with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

B. Provide a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. For wall-mounted mirrors, install mirrors with mastic and mirror hardware.
   1. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
   2. For mirror hardware in the form of continuous J-channels at bottom, provide setting blocks 1/8 inch (3 mm) thick by 4 inches (100 mm) long at quarter points. To prevent trapping water, provide, between setting blocks, 2 slotted weeps not less than 1/4 inch (6.4 mm) wide by 3/8 inch (9.5 mm) long.
   3. For mirror hardware in the form of a continuous J-channel at bottom and continuous top trim at top, fasten J-channel directly to wall and attach top trim to continuous cleat fastened directly to wall.
   4. Install mastic as follows:
      a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.

b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.

c. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time

D. Remove labels after Work is completed.

E. Clean, wash and polish surfaces following manufacturer's recommendations

- END OF SECTION -

- SECTION 08 9000 -

LOUVERS & VENTS

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. Fixed, aluminum louver mounted in steel frame; building fin.

1.3 RELATED SECTIONS

A. Section 05 5000 “Metal Fabrications” for tube steel supports of units

B. Section 07 9200 "Joint Sealants" for sealants installed in perimeter joints between louver frames and adjoining construction.

1.4 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.5 SYSTEM PERFORMANCE REQUIREMENTS

A. Structural Performance: Design, engineer, fabricate, and install exterior metal wall louvers to withstand the effects of loads and stresses from wind and normal thermal movement, without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; and permanent damage to fasteners and anchors:

1. Normal thermal movement is defined as that resulting from the following maximum change (range) in ambient temperature. Base design calculations on actual surface temperatures of metals due to both solar heat gain and night time sky heat loss.

   a. Temperature Change (Range): 100 deg F.

B. Air Performance, Water Penetration, and Air Leakage Ratings: Provide louvers complying with performance requirements indicated as demonstrated by testing manufacturers stock units, of height and width indicated, according to Air Movement and Control Association (AMCA) Standard 500.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. LEED Submittal:
   1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
      a. Include certificate indicating costs for each product having recycled content.
   2. Product Data for Credit EQ 4.2: For paints, including printed statement of VOC content and chemical components.

C. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
   1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
   2. Show mullion profiles and locations.
   3. Wiring Diagrams: For power, signal, and control wiring for motorized adjustable louvers.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification: For each type of metal finish required.

F. Delegated-Design Submittal: For louvers indicated to comply with structural performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

G. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

1.7 PROJECT CONDITIONS

A. Field Measurements: Check actual louver openings by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of the Work.
   1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabrication of louvers and vents without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to guaranteed dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Models as identified in articles in Part 2 of this section manufacture by Greenheck, Inc.,or subject to compliance with requirements, provide products by one of the following:

1. Greenheck, Inc.
2. Airolite Co.
3. Airstream Products Div., Penn Ventilator Co., Inc.
4. Arrow United Industries.
5. Construction Specialties, Inc. (C/S)
6. Reliable Metal Products.
7. Ruskin Mfg. Div., Phillips Industries, Inc.

2.2 MATERIALS

A. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer to produce required finish.

B. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.

C. Fasteners: Of same basic metal and alloy as fastened metal, unless otherwise indicated. Do not use metals which are corrosive or incompatible with materials joined.

1. Use types, gages, and lengths to suit unit installation conditions.
2. Use Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

D. Anchors and Inserts: Of type, size, and material required for type of loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.

E. Bituminous Paint: SSPC-Paint 12 (cold-applied asphalt mastic).

2.3 FABRICATION, GENERAL

A. General: Fabricate louvers and vents to comply with requirements indicated for design, dimensions, materials, joinery, and performance.

B. Preassemble louvers in shop to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of size indicated with allowances made for fabrication and installation tolerances of louvers, adjoining construction, and perimeter sealant joints.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Where required, provide vertical mullions of type and at spacings indicated but not further apart than recommended by manufacturer, or 72 inches o.c., whichever is less. At horizontal joints between louver units provide horizontal mullions except where continuous vertical assemblies are indicated.

G. Provide sill extensions and loose sills made of same material as louvers, where indicated, as required for drainage to exterior and to prevent water penetrating to interior.

H. Join frame members to one another and to fixed louver blades as follows, unless otherwise indicated, or size of louver assembly makes bolted connections between frame members necessary:

1. With fillet welds, concealed from view; or mechanical fasteners; or a combination of these methods; as standard with louver manufacturer.

2.4 FIXED ALUMINUM FIN LOUVERS

A. Basis-of-Design Product: Greenheck, Model ESD-403 High Performance Drainable Blade Louver System ; or a comparable product of one of the following:

1. Airolite Co.
2. Airstream Products Div., Penn Ventilator Co., Inc.
3. Arrow United Industries.
4. Construction Specialties, Inc. (C/S)
5. Reliable Metal Products.
6. Ruskin Mfg. Div., Phillips Industries, Inc.

B. Louver Depth: As indicated on Drawings.

C. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, but not less than 0.080 inch (2.0 mm) for blades and 0.080 inch (2.0 mm) for frames.

D. Mullion Type: Exposed.

E. Performance Requirements:

1. Free Area: Not less than 8.0 sq. ft. (0.74 sq. m) for 48-inch- (1.2-m-) wide by 48-inch- (1.2-m-) high louver.
2. Point of Beginning Water Penetration: Not less than 950 fpm (4.8 m/s).
3. Air Performance: Not more than 0.10-inch wg (25-Pa) static pressure drop at 750-fpm (3.8-m/s) free-area velocity.

F. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.5 LOUVER SCREENS

A. General: Provide screen at each exterior louver.
   1. Screen Location for Fixed Louvers: Interior face.
   2. Screening Type: Insect screening.

B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
   1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
   2. Finish: Same finish as louver frames to which louver screens are attached.
   3. Type: Rewirable frames with a driven spline or insert for securing screen mesh.

D. Louver Screening for Aluminum Louvers:
   1. Insect Screening: Stainless steel, 18-by-18 (1.4-by-1.4-mm) mesh, 0.009-inch (0.23-mm) wire, located at building louvers.

2.6 FINISHES

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Finish louvers after assembly.

C. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
   1. Color and Gloss: See Section 08 4113, match glazed aluminum storefront system
      a. Acceptable Coatings Manufacturers:
         1) PPG Industries, Inc.
         2) Valspar Corporation
         3) BASF

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions and directions for installation of anchorages which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.2 INSTALLATION

A. Locate and place louver units plumb, level, and in proper alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection. Systems shall be installed in a manner in which owner removal is accommodated.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect galvanized and nonferrous metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces which will be in contact with concrete, masonry, or dissimilar metals.

F. Install concealed gaskets, flashings, joint fillers, and insulation, as louver installation progresses where required to make louver joints weathertight. Comply with Division 7 Section "Joint Sealants" for sealants applied during installation of louver.

3.3 ADJUSTING AND PROTECTION

A. Protect louvers and vents from damage of any kind during construction period including use of temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at time of Substantial Completion.

B. Restore louvers damaged during installation and construction period, so that no evidence remains of correction work. If results of restoration are unsuccessful, as judged by Project Inspector, remove damaged units and replace with new units.

1. Clean and touch-up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

3.4 CLEANING

A. Periodically clean exposed surfaces of louvers, which are not protected by temporary covering, to remove fingerprints and soil during construction period; do not let soil accumulate until final cleaning.

B. Before final inspection, clean exposed surfaces with water and with a mild soap or detergent not harmful to finishes. Rinse thoroughly and dry surface.

- END OF SECTION -

DIVISION 09 – FINISHES

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- SECTION 09 2116 -

GYPSUM BOARD SHAFT WALL ASSEMBLIES

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. Shaft Enclosures
   2. Chase Enclosures
   3. Stair Enclosures
   4. Horizontal enclosures.

1.3 RELATED SECTIONS

A. Section 07 8446 "Fire-Resistive Joint Systems" for head-of-wall assemblies that incorporate gypsum board shaft-wall assemblies

B. Section 09 2216 “Non-Structural Metal Framing” for non-load bearing metal framing.

C. Section 09 2900 “Gypsum Board” for sheathing and finishes.

1.4 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board construction not defined in this Section or in other referenced standards.

1.5 PERFORMANCE REQUIREMENTS

A. Structural Performance:
   1. Provide gypsum board shaft-wall assemblies capable of withstanding the full air-pressure loads indicated for maximum heights of partitions without failing and while maintaining an airtight and smoke-tight seal. Evidence of failure includes deflections exceeding limits indicated, bending stresses causing studs to break or to distort, and end-reaction shear causing track (runners) to bend or to shear and studs to become crippled.

1.6 SUBMITTALS

A. Assembly test reports from a qualified independent testing agency certifying and substantiating compliance of gypsum board shaft-wall assemblies with structural and sound-attenuation performance requirements based on tests performed on manufacturers' standard assemblies representing those indicated.

B. LEED Submittals:
   1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.
   2. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
      a. Include statement indicating costs for each product having recycled content.

1.7 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance-Rated Assemblies: Indicated by design designations from FM's "Approval Guide, Building Products" and UL's "Fire Resistance Directory."

B. STC-Rated Assemblies: For gypsum board shaft-wall assemblies indicated to have STC ratings, provide assembly materials and construction complying with requirements of assemblies whose STC ratings were determined according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat on leveled supports off the ground to prevent sagging.

1.9 PROJECT CONDITIONS

A. Comply with requirements for environmental conditions, room temperatures, and ventilation specified in Section 09 2900 “Gypsum Board”.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Approved Manufacturers:
   1. G-P Gypsum Corporation, Georgia-Pacific Company (800-284-5347)

2. National Gypsum Company, Gold Bond Building Products Div. (800-628-4662).
3. United States Gypsum Co. (800-874-4968)

2.2 ASSEMBLY MATERIALS

A. General: Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.
   1. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints.
   2. Provide auxiliary materials complying with gypsum board shaft-wall assembly manufacturer's written recommendations.

B. Steel Framing: ASTM C 645.
   1. Protective Coating: ASTM A 653, G40, hot-dip galvanized coating

C. Gypsum Shaft-Liner Panels:
   1. Acceptable Manufacturer:
      a. “Dens-Glass Ultra Shaftliner”; G-P Gypsum Corporation
      b. "Sheetrock Brand Gypsum Liner Panels - Enhanced"; United States Gypsum Co..
   2. Type “X”, 1” thick water resistant gypsum core surfaced with coated glass mat facings that resist growth of mold and mildew and does not support fungus growth per ASTM D 3273 "Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber".

D. Gypsum Wallboard: ASTM C 36, core type as required by fire-resistance-rated assembly indicated.
   1. Refer to Section 09 2900 “Gypsum Board”.

E. Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Section 09 2900 “Gypsum Board”, that comply with gypsum board shaft-wall assembly manufacturer's written recommendations for application indicated.

F. Gypsum Wallboard Joint-Treatment Materials: ASTM C 475 and as specified in Section 09 2900 “Gypsum Board”.

G. 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.

H. Track (Runner) Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft-wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

I. Acoustical Sealant: As specified in Section 09 2900 “Gypsum Board”.

2.3 GYPSUM BOARD SHAFT WALL

A. Basis-of-Design Product: As indicated on Drawings by design designation of a qualified testing and inspecting agency.

B. Deflection Limit: L/240

C. Studs: Manufacturer's standard profile for repetitive members and corner and end members and for fire-resistance-rated assembly indicated.
   1. Depth: As indicated.
   2. Minimum Base Metal Thickness: As indicated on Drawings.

D. Track (Runner): Manufacturer's standard J-profile track with long-leg length as standard with manufacturer.
   1. Minimum Base Metal Thickness: As indicated on Drawings.

E. Jamb Struts: Manufacturer's standard J-profile strut with long-leg length of 3 inches, in depth matching studs, and not less than 0.0341 inch thick.

F. STC Rating: As indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to which gypsum board shaft-wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway door frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install gypsum board shaft-wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:
   1. ASTM C 754 for installing steel framing.
   2. Section 09 2900 “Gypsum Board”, for applying and finishing panels.

B. Do not bridge building expansion joints with shaft-wall assemblies; frame both sides of joints with furring and other support.

C. Install supplementary framing in gypsum board shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.
   1. At elevator hoistway door frames, provide jamb struts on each side of door frame.
   2. Where handrails directly attach to gypsum board shaft-wall assemblies, provide galvanized steel reinforcing strip, accurately positioned and secured behind at least 1 face-layer panel. Size of reinforcing plate as shown on Drawings.

D. Integrate stair hanger rods with gypsum board shaft-wall assemblies by locating cavity of assemblies where required to enclose rods.

E. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.

F. Isolate gypsum finish panels from building structure to prevent cracking of finish panels while maintaining continuity of fire-rated construction.

G. Install control joints to maintain fire-resistance rating of assemblies.

H. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with manufacturer's written instructions or ASTM C 919, whichever is more stringent.

I. In elevator shafts where gypsum board shaft-wall assemblies cannot be positioned within 2 inches of the shaft face of structural beams, floor edges, and similar projections into shaft, install 5/8-inch-thick, gypsum board cants covering tops of projections.
   1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft-wall framing.
   2. Where steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to the shaft-wall framing.

- END OF SECTION -

- SECTION 09 2216 -

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes non-load-bearing steel framing members for the following applications:
   1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
   2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

1.3 RELATED SECTIONS

A. Section 05 4000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

B. Section 07 2100 "Thermal Insulation" for insulation installed with Z-shaped furring members.

C. Section 07 8446 "Fire-Resistive Joint Systems" for head-of-wall joint systems installed with non-load-bearing steel framing.

D. Section 09 2116 "Gypsum Board Shaft-Wall Assemblies" for non-load-bearing metal shaft-wall framing, gypsum panels, and other components of shaft-wall assemblies.

E. Section 09 2900 “Gypsum Board” for gypsum panels.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing and firestop tracks capable of withstanding deflection within limits and under conditions indicated.
   1. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
      a. Upward and downward movement of 1 inch (25 mm).

1.5 SUBMITTALS

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

B. LEED Submittal:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
   a. Include statement indicating costs for each product having recycled content.

1.6 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40 (Z120)], hot-dip galvanized, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

B. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
   a. Type: Postinstalled, expansion anchor, such as .

C. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

D. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.

E. Flat Hangers: Steel sheet, 1 by 3/16 inch (25.4 by 4.76 mm) by length indicated.

F. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness, 0.05980-inch-minimum thickness of base (uncoated) metal and 7/16-inch-wide flanges, and as follows:

1. Carrying Channels: 2 inches deep, 590 lb per 1000 feet, unless otherwise indicated.
2. Finish: G-60 hot-dip galvanized coating per ASTM A 525 for framing for exterior soffits and where indicated.

G. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges, 3/4 inch (19.1 mm) deep.
2. Steel Studs: ASTM C 645.
3. Minimum Base-Metal Thickness: 0.0312 inch (0.79 mm).
4. Depth: As indicated on Drawings.
5. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.
6. Minimum Base Metal Thickness: 0.0312 inch (0.79 mm).
7. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep members designed to reduce sound transmission.
   a. Configuration: Asymmetrical or hat shaped.

H. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Armstrong World Industries, Inc.; Drywall Grid Systems.
   b. Chicago Metallic Corporation; 660-C Drywall Furring System.
   c. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.0312 inch (0.79 mm).
2. Depth: As indicated on Drawings.

B. Slip-Type Head Joints: Where indicated, provide the following:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.

C. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness compatible with studs and in width to accommodate depth of studs.

1. Basis-of-Design Product: Grace Construction Products; FlameSafe® FlowTrak® System. Subject to compliance with requirements, provide the specified product or a comparable product from one of the following:
   a. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
   b. Metal-Lite, Inc.; The System.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.0312 inch (0.79 mm), r as indicated on drawings.

E. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.

1. Depth: As indicated on Drawings.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38.1 by 38.1 mm), 0.068-inch- (1.73-mm-) thick, galvanized steel.

F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm), unless otherwise indicated..
2. Depth: 7/8 inch (22.2 mm).

G. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

H. Cold-Rolled Furring Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges.

1. Depth: As indicated on Drawings.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch (0.79 mm).
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare-metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (600 mm) o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
   3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   5. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m)] measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.
   1. Space studs as follows:
      a. Single-Layer Application: 16 inches (406 mm) o.c., unless otherwise indicated.
      b. Multilayer Application: 16 inches (406 mm) o.c., unless otherwise indicated.

c. Tile backing panels: 16 inches (406 mm) o.c., unless otherwise indicated.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
   a. Install two studs at each jamb, unless otherwise indicated.
   b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
   c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
   a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:
   a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
   b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches (150 mm) o.c.

D. Direct Furring:

1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

E. Z-Furring Members:

1. Erect insulation (specified in Division 7 Section "Thermal Insulation") vertically and hold in place with Z-furring members spaced 24 inches (610 mm) o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (600 mm) o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (300 mm) from corner and cut insulation to fit.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing, ASTM C 840.

- END OF SECTION -

- SECTION 09 2400 -

PORTLAND CEMENT PLASTERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section describes the requirements for furnishing and installing the following type(s) of portland-cement plaster:
   1. Exterior portland cement plasterwork (stucco) on metal lath and solid-plaster bases.
   2. Integral color acrylic finish coat.
   3. Liquid bonding agent over concrete and concrete masonry.
   4. Plaster accessories as required

1.3 RELATED SECTIONS

A. Section 03 3000 “Cast-in-Place Concrete” for direct application to cast-in-place substrate.

B. Section 06160 “Sheathing” for sheathing and weather resistant sheathing membrane beneath plaster assembly.

C. Section 07 6200 “Sheet Metal Flashing and Trim” for sheet metal flashing, trim and reglets.

D. Section 07 9200 “Joint Sealants” for providing a watertight seal to adjacent materials.

1.4 SUBMITTALS

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

B. LEED Submittals:

   1. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

      a. Include statement indicating costs for each product having recycled content.

C. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.

D. Shop Drawings: Show locations and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other work.

E. Samples for Initial Selection: For each type of factory-prepared finish coat indicated.

F. Samples for Verification: For each type of colored finish coat indicated; 18 by 18 inches (457 by 457 mm), and prepared on rigid backing.

G. Sand compliance certificates must be presented to the Architect with each load of sand.

H. Installers Certificate, signed by manufacture. Technical representative certifying that installers comply with requirements under “Quality Assurance” Section

1.5 REFERENCE STANDARDS

A. Resulting installed materials shall be acceptable in the jurisdiction of use. The work of this section shall comply with the latest editions of the following publications as applicable:

1. California Building Code (CBC)
2. International Conference of Building Officials (ICBO) Evaluation Service, Inc.—Evaluation Report Number ER-4617
3. American Society for Testing and Materials (ASTM)—Related specifications, tests, and standards
   a. ASTM: C1063 – Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement Based Plaster. C 926 – Application of Portland Cement Based Plaster.
4. Gypsum Association—Fire Resistance Design Manual GA-600, 14th Edition
5. APA The Engineered Wood Association
6. NAAMM – ML/SFA 920 Guide Specification for Metal Lathing and Furring
7. PCA – Portland Cement Plaster (Stucco) Manual
8. ICBO Evaluation Service, Inc. - Evaluation Report Number ER-4617

1.6 QUALITY ASSURANCE

A. The manufacturer or distributor should be capable of providing a local architectural representative to provide consultation.

1. A technical consultant supplied by the manufacturer or local distributor should be contacted to consult the installer for the application of finish on all samples and mock-ups and during the actual application.

B. Applicators Qualifications: Engage an experienced installer, who is certified, in writing by Plaster System as being qualified to install the plaster systems. The installer shall have 10 year’s experience with the products to be used on this project and have successfully completed the installation of a minimum of 50,000 square feet of the specified product.

C. Pre-installation Meeting: Plan and conduct a pre-installation meeting at the project site prior to the installation of any wall materials (including mock-ups). This meeting is to be attended by the Architect, General Contractor, Applicator of the system and the Technical Consultant, supplied by the local distributor.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Mockups: Prior to the installation of the plaster system work, provide a mock-up panel to demonstrate aesthetic effects and set quality standards for materials and execution. Panel must be constructed as per the Architects size and dimension requirements using materials specified for final work. The panel must be constructed as per the Architects size and dimension requirements. Demonstrate the proposed range of color, texture and workmanship to be expected in the completed work. Show a cut-away in the panel exposing the weather barrier, metal lath and drainage weep of the system on a perimeter edge of the panel. Obtain Architect's acceptance of visual qualities of the sample panel..

1. Panel Size: Unless otherwise noted; provide a mock-up panel 8 feet by 8 feet into the wall/roof mock-up required for the project. Mock-up installed to show finish and terminations adjacent to material used in project. Mock-up to show plaster at returns and corners.
2. Additional panels to be constructed as need until finish, color and consistency is approved by Architect.
3. Maintain sample panel throughout the construction process and dispose of when project is completed.

E. The work shall be free from excessive non-uniformity. The surface of the finish shall show consistency and uniformity that is within the same standards set by other projects of similar scope, using the same materials and good plastering practices, in the immediate geographic area to the project specified herein.

F. Non-uniformity visible under critical lighting means shadowing or reflection on the surface of the finish that may highlight non-uniformity and/or undulations. Under critical lighting, the appearance of the finish shall be within industry standards set by other projects of similar scope, using similar materials and good plastering practices, in the immediate geographical area to the project specified herein.

G. Scaffolds and Equipment:

1. Install and maintain all necessary scaffolds, staging, trestles and planking, in strict conformance with CCR Title 8 and all applicable laws and ordinances.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

B. Sand must be placed on a protective surface and covered when not in use.

1.8 PROJECT CONDITIONS

A. Comply with ASTM C 926 requirements.

B. Exterior Plasterwork:

1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
2. Allow cast-in-place concrete to cure to fully cure at a minimum of 28days prior to applying base coat or accessories.
3. Apply plaster when ambient temperature is greater than 40 deg F (4.4 deg C) not to exceed 110 deg F (44.4 deg C). Ambient air temperature must be maintained at a minimum of 40 deg ºF (4ºC) or higher for at least 24 hours after application to allow proper curing.
4. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

C. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 METAL LATH

A. Expanded-Metal Lath: ASTM C 847 with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Alabama Metal Industries Corporation; a Gibraltar Industries company.
   b. CEMCO.
   c. Clark Western Building Systems.
   d. Dietrich Metal Framing; a Worthington Industries company.
   e. MarinoWARE.
   f. Phillips Manufacturing Co.
2. Diamond-Mesh Lath: Self-furring, 3.4 lb/sq. yd. (1.8 kg/sq. m).

2.2 ACCESSORIES

A. General: Comply with ASTM C 1063 and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Alabama Metal Industries Corporation; a Gibraltar Industries company.
   b. CEMCO.
   c. Clark Western Building Systems.
   d. Delta Star, Inc; Superior Metal Trim.
   e. Dietrich Metal Framing; a Worthington Industries company.

f. MarinoWARE.
g. Phillips Manufacturing Co.
h. Stockton Products.

2. Foundation Weep Screed: Fabricated from hot-dip galvanized-steel sheet, ASTM A 653/A 653M, G60 (Z180) zinc coating.
3. Cornerite: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
4. External-Corner Reinforcement: Fabricated from metal lath with ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
5. Cornerbeads: Fabricated from zinc or zinc-coated (galvanized) steel.
   a. Small nose cornerbead with expanded flanges; use unless otherwise indicated.
6. Casing Beads: Fabricated from zinc or zinc-coated (galvanized) steel; square-edged style; with expanded flanges.
7. Control Joints: Fabricated from zinc or zinc-coated (galvanized) steel; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
8. Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
9. Two-Piece Expansion Joints: Fabricated from zinc or zinc-coated (galvanized) steel; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch (6.34 to 16 mm) wide; with perforated flanges.

2.3 MISCELLANEOUS MATERIALS

A. Water for Mixing: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch (13 mm) long, free of contaminants, manufactured for use in portland cement plaster.

C. Bonding Compound: ASTM C 932.

D. Steel Drill Screws: For metal-to-metal fastening, ASTM C 1002 or ASTM C 954, as required by thickness of metal being fastened; with pan head that is suitable for application; in lengths required to achieve penetration through joined materials of no fewer than three exposed threads.

E. Fasteners for Attaching Metal Lath to Concrete Substrates: Complying with ASTM C 1063, Sections 7.10.4 and 7.10.5.
   1. Low velocity power and powder actuated fasteners, ITW Ramset Trakfast or similar, zinc coated fasteners as follows:
      a. Shank Diameter: 0.109
      b. Enbedment: 3/4-inch, minimum

F. Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.0475-inch (1.21-mm) diameter, unless otherwise indicated.

G. Sealant: As specified in Division 7 Section 07 9200 "Joint Sealants".

2.4 PLASTER MATERIALS

A. Basis of Design: Parex DPR Acrylic Finish as manufactured by ParexLahabra, Inc. French Camp, CA. tel: (209) 983-8002 or (800) 983-6953, fax (209) 983-1431, web: www.parex.com.

B. Multi-Coat Acrylic-Based Finish Coatings: Factory-mixed acrylic-emulsion coating systems, formulated with colorfast mineral pigments and fine aggregates; for use over portland cement plaster base coats. Include manufacturer's recommended primers and sealing topcoats for acrylic-based finishes.

1. Parex Finish: Factory blended 100% acrylic polymer based finish, integrally colored. Finish type, texture and color as follows.
   a. Color: Match Architect's sample
   b. Textures:
      1) Ultra Sand Smooth.
      2) Raked to match Architect’s sample.

C. Fiber-reinforced Portland cement stucco base

1. Fiber-47 Concentrate: Manufacturer's standard pre-mixed stucco basecoats consisting of portland cement and alkali resistant fiberglass and acrylic fibers and proprietary ingredients.
2. Jobsite added sand:
   a. ASTM C897, washed natural sand and graded conforming to ASTM C926
3. Waterproofing Admix: Red Label Suconem by Super Concrete Emulsions Ltd.,
   a. Anti-Hydro, or approved equal.

D. Adacryl: 100 percent acrylic emulsion additive for portland cement based products, to enhance curing, adhesion, freeze-thaw resistance and workability.

E. Bonding Agent: acrylic polymer based bonding agent for portland cement based products to increase shear bond adhesion.

F. Primers:

1. Primer 310: 100% acrylic based coating to prepare surfaces for Parex finishes.
2. Parex tintable primer, or approved equal.

G. Water: Clean, potable and from domestic source.

H. Plastic Cement: ASTM C 1328.

I. Lime: ASTM C 206, Type S; or ASTM C 207, Type S.

2.5 PLASTER MIXES

A. General: Comply with ASTM C 926 for applications indicated.

1. Accurately proportion materials for each stucco batch with measuring devices of known volume.
2. Size batches for complete use within maximum of one hour after mixing.
3. Re-temper stucco stiffened from evaporation, but do not use or re-temper partially hydrated cement stucco.

4. Do not use frozen, caked or lumpy materials, and remove such materials from jobsite immediately.
5. Mix factory prepared cement stucco in accordance with manufacturer's written instructions.
6. Use moist, loose sand in proportions recommended by basecoat concentrate manufacturer.
7. Withhold 10% of mixing water until mixing is nearly complete, then add as needed to produce desired working consistency.

B. Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork using Parex 47, or approved equal a fiber-reinforced factory blended scratch and brown mix for plaster systems having to conform to ASTM C 926-97as follows:

C. Factory-Prepared Finish-Coat Mixes: For acrylic-based finish coatings, comply with manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

B. Prepare solid substrates for plaster that are smooth or that do not have the suction capability required to bond with plaster according to ASTM C 926.

3.3 INSTALLATION, GENERAL

A. Exterior Sealant: Where required, seal joints between edges of plasterwork and abutting construction with sealant as specified in Section 07 9200.

3.4 INSTALLING METAL LATH

A. Expanded-Metal Lath: Install according to ASTM C 1063.
1. Partition Framing and Vertical Furring: Install flat diamond-mesh lath.
2. Flat-Ceiling and Horizontal Framing: Install 3/8-inch (9.5-mm) rib lath lath.
3. On Solid Surfaces, Not Otherwise Furred: Install self-furring, diamond-mesh lath.

3.5 INSTALLING ACCESSORIES

A. Install according to ASTM C 1063 and at locations indicated on Drawings.

B. Reinforcement for External Corners:
   1. Install lath-type, external-corner reinforcement at exterior locations.
   2. Install cornerbead at interior and exterior locations.

C. Control Joints: Install control joints in specific locations approved by Architect for visual effect as follows:
   1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
      a. Vertical Surfaces: 144 sq. ft. (13.4 sq. m).
      b. Horizontal and other Nonvertical Surfaces: 100 sq. ft. (9.3 sq. m).
   2. At distances between control joints of not greater than 18 feet (5.5 m) o.c.
   3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
   4. Where control joints occur in surface of construction directly behind plaster.
   5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

3.6 PLASTER APPLICATION

A. General: Comply with ASTM C 926.
   1. Do not deviate more than plus or minus 1/4 inch in 10 feet (6.4 mm in 3 m) from a true plane on finished plaster surfaces, as measured by a 10-foot (3-m) straightedge placed on surface.
   2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.
   3. Provide plaster surfaces that are ready to receive field-applied finishes indicated.

B. Bonding Compound: Apply on unit masonry and concrete plaster bases.

C. Number of Coats: Provide three-coat application over metal lath in accordance with ASTM C926.
   1. Apply plaster by hand or machine spray. If machine applied, use only experienced machine applicator foreman and nozzleman. Slump for machine applied plaster shall be between 2-1/2- to 4-inches at mixer and 2- to 3-1/2-inches at nozzle.
   2. Interrupt plaster coats only at junctions of plaster planes, at openings, or at control joints.
   3. Apply scratch coat with sufficient material and pressure to form full keys through and to embed metal base. When firm, score in one direction.
   4. Apply brown coat to scratch coat, bringing out to grounds, flat to true surface, and free of imperfections that would reflect in finish coat.
   5. Reconsolidate brown coat by floating, and roughen to assure bond with finish coat.
   6. Apply finish coat in accordance with manufacturer's instructions and uniformly float to true, even surface.

7. Nominal Plaster Thickness Measured from Face of Lath, in accordance with ASTM C929, Table 4:
   a. Vertical Surfaces:
      1) Scratch Coat: 3/8-inch, minimum.
      2) Brown Coat: 3/8-inch.
      3) Finish Coat: 1/8-inch, minimum.
   b. Horizontal Surfaces:
      1) Scratch Coat: 1/4-inch.
      2) Brown Coat: 1/4-inch.
      3) Finish Coat: 1/8-inch.

D. Ceilings; Base-Coat Mixes for Use over Metal Lath: Scratch and brown coats for three-coat plasterwork; 1/2 inch (13 mm) thick, 3/4 inch (19 mm) thick on concrete.
   1. Application of Base Coats on Lath:
      a. Scratch Coat: Apply scratch coat not less than 3/8" thick from face of supports to crest of scores, completely embedding and forming good key on metal lath. Thoroughly scratch in one direction only and keep at optimum moisture content with fog spray for 48 hours minimum before second coat is applied.
      b. Brown Coat: Reconsolidate brown coat by only lightly floating after hydration of the cement has commenced and sufficient moisture has evaporated, so that surface sheen has disappeared, but before the base/brown coat has become to rigid to be moved under float.
      c. Using a (Conventional) steel trowel cut back around trim edges approximately 1/16th of an inch, this will allow the finish to level off flush to the trim edges.
      d. Leave the face of the base coat only slightly rough using a steel trowel to receive finish.
      e. Maintain the brown coat moist for 48 hours, and allow to air cure for 7 days before applying acrylic skim coat.

E. Number of Coats: Provide two-coat application over masonry surfaces in accordance with ASTM C926.
   1. Apply brown/scratch coat, flat to true surface, and free of imperfections that would reflect in finish coat.
   2. Reconsolidate brown coat by floating, and roughen to assure bond with finish coat.
   3. Apply finish coat in accordance with manufacturer's instructions and uniformly float to true, even surface.
   4. Nominal Plaster Thickness Measured from Face of masonry, in accordance with ASTM C929, Table 4:
      a. Vertical Surfaces:
         1) Brown Coat: 3/8-inch.
         2) Finish Coat: 1/8-inch, minimum.
      b. Horizontal Surfaces:
         1) Brown Coat: 3/8-inch.
         2) Finish Coat: 1/8-inch.

F. Primer Application: Apply to all plaster surfaces using roller or spray equipment.

G. Acrylic-Based Finish Coatings: Apply coating system, including primers, finish coats, and sealing topcoats, according to manufacturer's written instructions and as follows:

1. Apply first coat of Plaster System Smooth Sand Finish approximately 1/16th of an inch over entire skim coated panel using a steel trowel, allow for the first coat to begin its set, then double back with a second coat using hard plastic float.
2. Apply the second coat approximately 1/16th of an inch and allow for the material to achieve a slight set, then float to a light sand without leaving directional lines and or burnish marks to a uniform surface.
3. Work so that the entire wall can be completed at one time so as to eliminate joining lines and overlaps. Overlaps and cold joints are unacceptable and will be rejected.

3.7 FINISH

A. Cement Finish: Mix in accordance with the appropriate sections of IBC Table 25A-F.

1. Exterior: Smooth float texture cement plaster shall be in accordance with the manufacturers recommendation for Smooth Float Portland Cement Plaster.
2. Tolerances: Maximum variation from true flatness shall be 1/4-inch in 10 feet.

3.8 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blemishes, blisters, pits, buckles, crazing and check cracking, dry outs, discolorations, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

B. Remove defective plaster and replace with conforming modified plaster as approved by manufacture. Restore surfaces damaged, stained, or defaced by plastering as directed to match adjacent areas to the acceptance of the Architect.

3.9 FIELD QUALITY CONTROL

A. Independent third party sand testing may be required at the request of the Architect/Owner.

3.10 PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering

- END OF SECTION -

- SECTION 09 2710 -

GLASS-REINFORCED GYPSUM FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes factory-molded, glass-reinforced gypsum (GRG) fabrications for ceiling access panels.

1.3 RELATED SECTIONS

A. Section 09 2216 "Non-Structural Metal Framing" for steel framing, blocking, and bracing supporting GRG fabrications.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, weights, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show profiles, thicknesses, embedded supports, and anchorage details for fabrications. Indicate requirements for joint treatment, clearances, and attachment to supports.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to GRG fabrications and to building structure.
3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and moldings.

D. Samples: For each exposed product in each profile and size required, and as follows:

1. Submit three 8 inch x 8 inch (203 mm x 203 mm) G.R.G. flat samples for paint selection.

E. LEED Submittal: Product data for Credit EQ 4.1 for construction adhesive, including printed statement of VOC content.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C 1467/C 1467M.

1.6 PROJECT CONDITIONS

A. Environmental Conditions:
   1. Comply with requirements in ASTM C 1467/C 1467M.
   2. Do not deliver or install GRG fabrications until building is enclosed, wet work is complete, and HVAC system is operating and continuously maintaining temperature and relative humidity at levels intended for building occupants.

B. Conditioning: Acclimatize GRG fabrications to ambient temperature and humidity of spaces in which they will be installed. Remove packaging and move units into installation spaces not less than 48 hours before installing them.

C. Field Measurements: Where GRG fabrications are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 COORDINATION

A. Coordinate layout and installation of GRG fabrications with support components specified in other Sections.

PART 2 - PRODUCTS

2.1 GRG FABRICATIONS

A. Fabrications: Molded, glass-reinforced gypsum units complying with ASTM C 1381.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. InterSource Specialties Company, Plymouth, WI, tel: (920) 892-8822, web: www.intersourceco.com
      b. IntexForms, Inc., Sacramento, CA, tel: (916) 388-9933, web: www.intexforms.com

B. Embedments: As standard with GRG fabrication manufacturer and as required for reinforcement and for anchorage to substrates and framing.

2.2 AUXILIARY MATERIALS

A. Steel Drill Screws: Of sufficient length and size to securely fasten GRG fabrications to framing members, and as follows:
   1. Screws complying with ASTM C 1002 for fastening GRG fabrications to steel members less than 0.033 inch (0.84 mm) thick.

2. Screws complying with ASTM C 954 for fastening GRG fabrications to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

B. Joint-Treatment Materials: ASTM C 475/C 475M.

2.3 FABRICATION

A. Fabricate GRG units to comply with ASTM C 1381, with smooth-finished surfaces; repair hollows, voids, scratches, and other surface imperfections. Fabricate units in lengths and sizes that will minimize number of joints between abutting units.

B. Embedments: Incorporate embedments into units to develop the full strength of GRG fabrications. Cover embedments with not less than 3/16-inch (5-mm) thickness of GRG composite.

C. Connection Hardware: Designed and fabricated to support and connect GRG fabrications to hangers, support framing, and substrates.

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 work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GRG INSTALLATION

A. Comply with requirements in ASTM C 1467/C 1467M.

B. Install GRG fabrications level, plumb, true, and aligned with adjacent materials. Use concealed shims where required for alignment.

C. Attach GRG fabrications to framing and substrates with steel drill screws, unless otherwise indicated. Do not use pneumatic staple guns. Countersink screw heads below adjoining finished surface.

1. Predrill fastener holes in units. Clean fastener holes to remove dirt and oil.
2. Locate fasteners not less than 5/16 inch (7.9 mm) from edges or ends of units.

D. Use joint-treatment materials to finish GRG fabrications to produce surfaces ready to receive primers and paint finishes specified in other Division 9 Sections.

1. Finish joints between units, other than control joints, and countersunk fastener heads to comply with ASTM C 840 for Level 4 and to match surface texture of units.
2. Repair hollows, voids, scratches, and other surface imperfections on units.

- END OF SECTION -

- SECTION 09 2900 -

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. This Section includes the following:
   1. Interior gypsum wall board, including moisture resistant gypsum wall board.
   2. Preparing and finishing concrete ceilings.

1.3 RELATED SECTIONS

A. Section 05 4000 "Cold-Formed Metal Framing" for load-bearing steel framing that supports gypsum board.

B. Section 07 2100 "Thermal Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.

C. Section 07 8446 "Fire-Resistive Joint Systems" for head-of-wall assemblies that incorporate gypsum board.

D. Section 09 2216 “Non-Structural Metal Framing” for interior suspension systems.

E. Section 09 2116 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.

F. Section 09 3013 “Ceramic Tile” for coordination of tile over the gypsum board and glass-mat, water-resistant backing board.

G. Section 09 8100 “Acoustical Insulation” for acoustical insulation installed in assemblies that incorporate gypsum board.

H. Section 09 9123 “Interior Painting” for primers applied to interior gypsum board surfaces.

1.4 SUBMITTALS

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

B. Samples: For the following products:
   1. Textured Finishes: 24-inches by 24-inches for each textured finish indicated and on same backing indicated for Work.

C. LEED Submittals:
   1. Product Data for Credit MR 4.1 and MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
      a. Include statement indicating costs for each product having recycled content.
   2. Product Data for Credit EQ 4.1: For adhesives used to laminate gypsum board panels to substrates, including printed statement of VOC content.

1.5 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Spray applied textured finish installers shall have successfully completed within last three years, at least three textured coating applications similar in type and size of this project.
   1. Mockups: Provide a sample application in one Guest Room of both ceilings and wall for acceptance by the Owner's representative and to serve as a sample standard of quality for the balance of the work. Rework sample room if necessary to obtain Owner's acceptance.
      a. Location to be selected by Architect, if not identified on drawings.

1.6 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.7 PROJECT 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 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 PANELS, GENERAL

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

2.2 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

B. Wall Type:
   1. Type X:
   2. Thickness: 5/8 inch (15.9 mm).
   3. Long Edges: Tapered.

C. Glass-Mat, Mold & Mildew Resistant Interior Wall Panel
   1. Manufacturer: "DensArmor Plus Interior Guard"; G-P Gypsum Corporation (800-225-6119)
   2. ASTM C1177, enhanced mold & mildew resistant gypsum core wallboard. Conforming to the physical properties of ASTM C36 and ASTM C1177 on Glass mat back. Rating of 10 "No Mold Growth" as tested for 4 weeks according to ASTM D3273.
      a. Surfaces to be Painted: Coated inorganic glass mat-faced back and paper-faced front.
      b. Surfaces to be covered with Wallcovering or other finish: Coated inorganic glass mat-faced back and front.
   3. Core: 5/8 inch, Type X
   4. Long Edges: Tapered.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. American Gypsum Co.
   b. G-P Gypsum.
   c. Lafarge North America Inc.
   d. National Gypsum Company.
   e. PABCO Gypsum.
   f. USG Corporation.

E. Flexible Type: Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
   1. Thickness: 1/4 inch (6.4 mm).
   2. Long Edges: Tapered.

F. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
1. Thickness: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.

G. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board.
1. Core: Similar to fiber-rock VH1 panels manufactured by USG. 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.

H. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.

2.3 TILE BACKING PANELS

A. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M or ASTM C 1396/C 1396M.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. American Gypsum Co.
b. BPB America Inc.
c. G-P Gypsum.
d. Lafarge North America Inc.
e. National Gypsum Company.
f. PABCO Gypsum.
g. Temple.
h. USG Corporation.
2. Core: 5/8 inch (15.9 mm), Type X.

B. Glass-Mat, Water-Resistant Backing Board:
1. Complying with ASTM C 1178/C 1178M.
a. Product: Subject to compliance with requirements, provide "DensShield Tile Guard" by G-P Gypsum.
2. Complying with ASTM C1177/C 1177M.
a. Product: Subject to compliance with requirements, provide "DensArmor Plus Interior Guard" by G-P Gypsum.
3. Core: Thickness as indicated on Drawings.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
   2. Shapes:
      a. Cornerbead.
      b. Bullnose bead.
      c. LC-Bead: J-shaped; exposed long flange receives joint compound.
      d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
      e. Expansion (control) joint.
      f. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Fry Reglet Corp.
      b. Gordon, Inc.
      c. Pittcon Industries.
   2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
   3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.5 JOINT TREATMENT MATERIALS

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

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.
   2. Exterior Gypsum Soffit Board: Paper.
   3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints 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.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   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. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

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.
   1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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 (0.84 to 2.84 mm) 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 Sealant: As specified in Division 7 Section "Joint Sealants."

F. Thermal Insulation: As specified in Division 7 Section "Thermal Insulation."

G. Vapor Retarder: As specified in Division 7 Section "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, 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 (1.5 mm) 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. (0.7 sq. m) 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- (6.4- to 9.5-mm-) 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- (6.4- to 12.7-mm-) 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.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: Vertical surfaces, unless otherwise indicated.
2. Flexible Type: Apply in double layer at curved assemblies.
3. Ceiling Type: As indicated on Drawings.
4. Abuse-Resistant Type: As indicated on Drawings.
5. Moisture and Mold-Resistant type at all restrooms, janitor rooms, locker rooms, toilet rooms, and concession room unless otherwise shown.

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 horizontally (perpendicular 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 stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
   3. On 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.

C. Multilayer Application:
   1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
   2. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
   3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Curved Surfaces:
   1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- (300-mm-) long straight sections at ends of curves and tangent to them.
   2. For double-layer construction, fasten base layer to studs with screws 16 inches (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.

3.4 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
   1. Install with 1/4-inch (6.4-mm) open space where panels abut other construction or structural penetrations.
   2. Fasten with corrosion-resistant screws.

3.5 APPLYING TILE BACKING PANELS

A. Water-Resistant Gypsum Backing Board: Install at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

B. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

C. Areas Not Subject to Wetting: Install regular-type gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.

D. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 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. Bullnose Bead: Use at outside corners.
2. U-Bead: Use at exposed panel edges.
3. Curved-Edge Cornerbead: Use at curved openings.

D. Exterior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.

E. Aluminum Trim: Install in locations indicated on Drawings.

3.7 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 and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below 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 3: Where heavy wallcovering is installed.
4. Level 4: Exposed surfaces in finished rooms and areas.
   a. Primer and its application to surfaces are specified in other Division 9 Sections.

5. Level 5: For gypsum board surfaces to receive semi-gloss and gloss interior paint (for walls and ceilings in wet areas).
   a. Primer and its application to surfaces are specified in other Division 9 Sections.

E. For level 4 gypsum board finish, embed tape in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration. Use the following joint compound combination:
   1. Embedding and First Coat: Ready-mixed, drying-type, all-purpose or taping compound.
   2. Fill (Second) Coat: Ready-mixed, drying-type, all-purpose or topping compound.
   3. Finish (Third) Coat: Ready-mixed, drying-type, all-purpose or topping compound.

F. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

3.8 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

3.9 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

- END OF SECTION -

- SECTION 09 3013 -

CERAMIC TILE

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. Ceramic tile.
   2. Stone thresholds.
   3. Waterproof membrane.
   4. Crack isolation membrane.
   5. Tile backing panels.
   6. Metal edge strips.

1.3 RELATED SECTIONS

A. Section 07 9200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

B. Section 09 2900 "Gypsum Board" for glass-mat, water-resistant backer board.

1.4 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.5 PERFORMANCE REQUIREMENTS

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

1. Level Surfaces: Minimum Level Surfaces: Minimum 0.6.

1.6 SUBMITTALS

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

B. LEED Submittal:

1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.

C. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

D. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

E. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches (300 mm) square, but not fewer than 4 tiles. Use grout of type and in color or colors approved for completed Work.
3. Full-size units of each type of trim and accessory for each color and finish required.
4. Stone thresholds in 6-inch (150-mm) lengths.
5. Metal edge strips in 6-inch (150-mm) lengths.

F. Qualification Data: For qualified Installer.

G. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

H. Product Certificates: For each type of product, signed by product manufacturer.

I. Material Test Reports: For each tile-setting and -grouting product and special purpose tile.

1.7 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile from one source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
   1. Stone thresholds.
   2. Waterproof membrane.
   3. Crack isolation membrane.
   4. Joint sealants.
   5. Glass-Mat, Water-Resistant backer units.
   6. Metal edge strips.

D. Preinstallation Conference: Conduct conference at Project site.
   1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.9 PROJECT CONDITIONS

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

1.10 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
   2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

E. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

A. Tile Type: Wall tile.
   1. Product: Dal Tile; Keystones ColorBody Porcelain Tiles. No substitutions allowed.
   2. Face Size: 6 inches by 6 inches (152 by 152 mm).
   3. Thickness: 1/4 inch (6.4 mm).
   4. Tile Colors:
      a. D311 Ebony
   5. Pattern: Refer to Drawings.
   6. Grout Color: As selected by Architect from manufacturer's full range.
   7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
   8. Built-up Base: Style MB-5A: Coved with surface bullnose top edge, face size: 2 inches by 2 inches (50 by 50 mm).

B. Glazed Wall Tile: ANSI A137.1, and as follows:
   1. Product: Daltile Semi-Gloss, clear high gloss finish; moisture absorption 0.5 percent or less. No substitutions allowed.
   2. Nominal Facial Dimensions: 6 by 6-inch, nominal.
   3. Face: Smooth with Cushioned Edges.
   4. Nominal Thickness: 1/4 inch.
   5. Trim Units: Matching bead, cove, and surface bullnose shapes in sizes coordinated with field tile

6. Tile Patterns: Refer to drawings.
7. Tile Colors
   a. 190 Arctic White.
8. Pattern: Refer to Drawings.
9. Grout Color: As selected by Architect from manufacturer's full range.
10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
    a. Field: 0190 Arctic White
    b. Liners: 0190 Arctic White
       1) Size: 1 inch by 6 inch.
    c. Accent: 0190 Arctic White
       1) Matte Finish.
    d. Bullnose: 0190 Arctic White

C. Tile Type: Floor tile.
1. Product: Dal Tile; Keystones ColorBody Porcelain Tiles. No substitutions allowed.
2. Face Size: 2 inches by 2 inches (50 by 50 mm).
3. Thickness: 1/4 inch (6.4 mm).
4. Tile Colors:
   a. D138 Gold Dust
   b. D050 Mottled Medium Brown
   c. D156 Brownstone Range
   d. D311 Ebony
5. Grout Color: As selected by Architect from manufacturer's full range.
6. Pattern: Refer to Drawings.
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
   a. Field and border units.

2.3 STONE THRESHOLDS

A. General: Provide stone (marble) that is uniform in color and finish, fabricated to sizes and profiles indicated or required to provide transition between tile surfaces and adjoining finished floor surfaces. Transition shall comply with ADA requirements.

B. Marble Thresholds: Provide marble thresholds complying with ASTM C 503 requirements for exterior use and for abrasion resistance where exposed to foot traffic, a minimum hardness of 10 per ASTM C 241.
1. Colors, Patterns, and Finishes: Refer to drawings.

2.4 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board with Water-Resistant Coating: ASTM C 1178/C 1178M.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide G-P Gypsum Corporation; "DensShield Tile Backer" or a comparable product by another manufacturer.
   2. Core: As indicated on Drawings.
   3. Long Edges: Square.

B. Glass-Mat, Water-Resistant Tile-Backing Panel: ASTM C1177/C 1177M.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide G-P Gypsum Corporation; "DensArmor Plus Paperless Interior Panel" or a comparable product by another manufacturer.
   2. Core: As indicated on Drawings.
   3. Long Edges: Tapered.

2.5 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.
   1. Products: Subject to compliance with requirements, provide the following:
      a. Noble Company (The); Nobleseal TS.

2.6 CRACK-SUPPRESSION MEMBRANES FOR THIN-SET TILE INSTALLATIONS

A. General: Manufacturer's standard product that complies with ANSI A118.10.

B. Concrete Subfloors: Chlorinated-Polyethylene-Sheet Product: Nonplasticized, chlorinated polyethylene faced on both sides with high-strength, nonwoven polyester fabric, for adhering to latex-portland cement mortar; 60 inches (1524 mm) wide.
   1. Membrane: Minimum 30 mil thick load bearing membrane, capable of withstanding 1/4-inch horizontal structural crack and joint movement
   2. Self-adhering, pressure sensitive formulation is acceptable
   3. Basis of Design: Noble Company (The); Nobleseal TS.
      a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
         1) National Applied Construction Products, Inc.; ECB Membrane
         2) Protecto Wrap Company; Protecto Wrap.

2.7 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Boiardi Products; a QEP company.
      b. Bonsal American; an Oldcastle company.
      c. Bostik, Inc.
      d. C-Cure.
      e. Custom Building Products.
      f. Jamo Inc.
      g. Laticrete International, Inc.
      h. MAPEI Corporation.
      i. Mer-Kote Products, Inc.
      j. Southern Grouts & Mortars, Inc.
      k. Summitville Tiles, Inc.
      l. TEC; a subsidiary of H. B. Fuller Company.
   2. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.
   3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.8 GROUT MATERIALS

A. Standard Cement Grout: ANSI A118.6.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide products manufactured by Bostik, Inc.

2.9 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with requirements of Division 7 Section "Joint Sealers," including ASTM C 920 as referenced by Type, Grade, Class, and Uses.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

C. One-Part Mildew-Resistant Silicone Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and temperature extremes.

D. Products: Subject to compliance with requirements, provide one of the following:
   1. One-Part Mildew-Resistant Silicone Sealant:
      a. "Dow Corning 786"; Dow Corning Corp.
      b. "SCS 1702"; General Electric Co.
      c. "863 #345 White"; Pecora Corp.

d. "Rhodorsil 6B White"; Rhone-Poulenc Inc.

e. "Proglaze White"; Tremco Corp.

2.10 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness; metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications, and stainless steel; ASTM A 666, 300 Series exposed-edge material with satin finish.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

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. Bonsal American; an Oldcastle company; Grout Sealer.
   b. Bostik, Inc.; CeramaSeal Grout & Tile Sealer.
   c. C-Cure; Penetrating Sealer 978.
   d. Custom Building Products; Grout and Tile Sealer.
   e. Jamo Inc.; Matte Finish Sealer.
   f. MAPEI Corporation; KER 003, Silicone Spray Sealer for Cementitious Tile Grout.
   g. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
   h. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.
   i. TEC; a subsidiary of H. B. Fuller Company; TA-257 Silicone Grout Sealer.

2.11 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
   a. Tile floors in wet areas.
   b. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
   c. Tile floors composed of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
   1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
   2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
   3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
   1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
   2. Glazed Wall Tile: 1/16 inch (1.6 mm).
   3. Decorative Thin Wall Tile: 1/16 inch (1.6 mm).

F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
   2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

H. Stone Thresholds: Install thresholds at termination of floor tile or where exposed edge of tile flooring meets carpet, wood, or other dissimilar flooring material. Threshold finishes flush with top of tile; set in same type of setting bed as abutting field tile unless otherwise indicated.
   1. Set thresholds in latex-portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent non-tile floor finish.

I. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

J. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 TILE BACKING PANEL INSTALLATION

A. Water-Resistant Gypsum Backing Board: Install at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

B. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

3.5 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.6 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.7 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

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

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.8 FLOOR INSTALLATION METHODS

A. Floor Tile: Install tile to comply with requirements indicated below for setting bed methods, TCA installation methods related to types of subfloor construction, and grout types:
   1. Portland Cement Mortar: ANSI A108.1
   2. Waterproofing Membrane: ANSI A118.10.
   3. Bond Coat: Latex-portland cement mortar, ANSI A108.1A or ANSI A108.5.
   4. Concrete Slab On Grade, Interior at Restrooms (sloped mortar bed): TCA F112-05 (with tile installed by Method F115-03 on cured bed).
   5. Concrete Slab on Grade, Interior, TCA F122, dry-set or latex Portland cement bond coat, with standard grout, unless otherwise indicated.
      a. Where waterproofing membrane is indicated, install in accordance with TCA F122, with latex-portland cement grout.
   6. Concrete Elevated Subfloors, Interior at Restrooms (sloped mortar bed over membrane): TCA F121-07 (with tile installed by Method F115-07 on cured bed).
   7. Grout: Standard sanded cement.

B. Stone Thresholds: Install stone thresholds at termination of floor tile or where exposed edge of tile flooring meets carpet, wood, or other dissimilar flooring material. Threshold finishes flush with top of tile; set in same type of setting bed as abutting field tile unless otherwise indicated.
   1. Set thresholds in latex-portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent nontile floor finish.

C. Expansion Joints: TCA EJ171-03.

3.9 WALL TILE INSTALLATION METHODS

A. Install types of tile designated for wall application to comply with requirements indicated below for setting-bed methods, TCA installation methods related to subsurface wall conditions, and grout types:
   1. Latex-Portland Cement Mortar: ANSI A108.6.
   2. Wet Areas, Interior (thinset): TCA W245-07 over water-resistant gypsum.
   3. Dry Areas, Interior (thinset): TCA W243-07.
   4. Grout: Standard sanded cement.

- END OF SECTION -

- SECTION 09 5113 -

ACOUSTICAL PANEL CEILINGS

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. Acoustical panels and suspended exposed grid ceiling system.

B. Products Furnished But Not Installed Under This Section: Anchors or inserts for suspension system.

1.3 REFERENCES

A. ASTM C 635 – Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

B. ASTM C 636 – Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

C. ASTM A 641 – Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

D. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

E. ASTM E 580 – Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.

F. ASTM E 1264 – Standard Classification for Acoustical Ceiling Products.

G. CISCA – Ceilings and Interior Systems Construction Association, "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies".

H. UBC. Standard No. 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-In Panel Ceilings."

1.4 SYSTEM REQUIREMENTS

A. Interface With Other Systems: Coordinate layout and installation of acoustical ceiling units and suspension system components with other work supported by, or penetrating through, ceilings, including but not limited to light fixtures, HVAC equipment, Laboratory Equipment, partition systems, and casework.

1.5 SUBMITTALS

A. Product Data: Submit product data for each acoustical material and suspension system component.

B. LEED Submittals:

1. Product Data for Credit MR 4.1 and MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
    a. Include statement indicating costs for each product having recycled content.

C. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.

D. Samples:

1. Submit samples of each acoustical ceiling unit and exposed suspension component specified for review of color and texture.
2. Show full range of texture and color expected in completed Work in each sample submission.
3. Panel: Submit 12-inch by 12-inch samples of each type.
4. Exposed Tees and Moldings: Submit one-foot lengths of each type suspension system, including moldings.

E. Submit following Informational Submittals:

1. Qualification Data: Installer's qualification data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in acoustical ceiling work having minimum of 3-years successful documented experience with work comparable to that indicated and specified.

B. Regulatory Requirements: Conform to local code for combustibility requirements for materials.

1. Panel units shall be Class A rated per ASTM E 1264 (25 or under flame spread and 50 or under smoke developed ratings tested in accordance with ASTM E 84), or Flame Spread Classification (Class I), per CBC Table 8-A.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Permit acoustical materials to reach room temperature and a stabilized moisture content before installation.

B. Maintain uniform temperature of minimum 60-degrees F and humidity of 20-percent to 40-percent prior to, during, and after installation.

1.9 SEQUENCING

A. Do not install interior acoustical ceilings until space is enclosed and weatherproof, wetwork in space is completed and nominally dry, and work above ceilings is complete.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
   1. Acoustic Tile:
      a. USG Interiors, Inc., Chicago, IL., Tel: (800) 964-4874, contact: Armando Diaz, Web: www.usg.com
      b. Armstrong World Industries, Inc., Lancaster, PA., Tel: (650) 685-1654, contact: Liesl Heil Morell, Web: www.armstrong.com
      c. Celotex, a Division of BPB, Tampa, FL, Tel: (925) 963-4945, contact: Richard Green, Web: www.bpb-na.com
      d. Or equal
   2. Suspension System:
      a. USG Interiors, Inc., Chicago, IL, Tel: (800) 964-4874, contact: Armando Diaz, Web: www.usg.com
      b. Armstrong World Industries, Inc., Lancaster, PA., Tel: (650) 685-1654, contact: Liesl Heil Morell, Web: www.armstrong.com
      c. Chicago Metallic, Chicago, IL, Tel: (408) 607-2585, contact: Jason Cottone, Web: www.chicagometallic.com
      d. Or equal.

2.2 MINERAL-BASE PANELS - WATER FELTED

A. Products: Subject to compliance with requirements, provide the following:
   1. Mineral Base Panels, Water Felted, with Painted Finish and Smooth and Perforated Pattern, Fire-Resistance Rated. Panel Characteristics Type III, Form 1 units per ASTM E 1264, with pattern designation E,G, with other panel characteristics as follows
      a. Mineral Base Panels: Water Felted, with Painted Finish and Fine Textured Pattern. Color: White.
         1) Panel: "Millenia ClimaPlus Illusion Two/24 Panels", by USG Interiors, Inc. (#78780).
         2) Size: 24 inches by 48 inches by 3/4-inch.

3) Grid: Donn DX /DXL Suspension System 15/16" wide.
4) Edge Detail: Shadowline Tapered.
5) NRC Range: 0.70.
6) CAC Range: 35.
7) LR: .85.
8) Warranty: Manufacturer's Lifetime 30 year warranty.

2. Mineral Base Panels, Water Felted, with Painted Finish and Smooth and Perforated Pattern. Panel Characteristics Type III, Form 2 units per ASTM E 1264, with pattern designation C,D,E, with other panel characteristics as follows
   a. Mineral Base Panels: Water Felted, with Painted Finish. Color: White.
      1) Panel: “Radar”, USG Interiors, Inc. (#2311), or equal.
      2) Size: 24 inches by 48 inches by 3/4 inch
      3) Grid: Donn DX/DXL Suspension System 15/16" wide
      4) Edge Detail: Square Edge.
      5) NRC: 0.60.
      6) CAC Min: 35.
      7) LR: 0.85
      8) Recycled content: Not less than 28.
      9) Warranty: Manufacturer's Lifetime 30 year warranty.
3. Mineral-Fiber Panels, Wet Formed with vinyl-coated aluminum foil surfaced acoustical panels. Panel Characteristics: Type X, Form X acoustical panels per ASTM E 1264, with vinyl-faced overlay, complying with pattern designation CGI, and other panel characteristics as follows:.
   a. Mineral Fiber Panels Wet Formed, with Soil-Resistant Vinyl Face, Fire-Resistance Rated. Color: White. Conform to Health Department requirements for installation in kitchen and cleanable, scrubbable environments
      1) Panel: "Clean Room ClimaPlus 10M-100M”, (#56090) USG Interiors, Inc.
      2) Size: 24 inches by 48 inches by 5/8 inch
      3) Grid: Donn DX/DXL Suspension System 15/16" wide.
      4) Edge Detail: Square Edge.
      5) NRC: Not less than 0.55.
      6) CAC Range: Not less than 35.
      7) LR: 0.79.
      8) Recycled content: Not less than 50.
      9) Warranty: Manufacturer's 15 year warranty.
4. Gypsum Core, Vinyl Faced, smooth and unperforated. Panel Characteristics Type XX, Form XX units per ASTM E 1264, with pattern designation G, with other panel characteristics as follows
   a. Gypsum Core, Vinyl Faced, smooth and unperforated. Color: White.
      1) Panel: “Sheetrock Brand Lay-In Ceiling Tile ClimaPlus”, USG Interiors, Inc. (#3270), or equal.
      2) Size: 24 inches by 48 inches by 1/2 inch
      3) Grid: Donn DX/DXL Suspension System 15/16" wide
      4) Edge Detail: Square Edge.

5) NRC: Not less than in accordance with ASTM C423. Product to have UL acoustical compliance.
6) CAC Min: 40.
7) LR: 0.77
8) Recycled content: Not less than 23.
9) Warranty: Manufacturer's 15 year warranty.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Exposed Suspension System:
1. Grid: ASTM C635, intermediate duty, exposed T; interlocking components designed to resist seismic lateral pullout.
2. Grid Materials: Cold-rolled steel with galvanized coating.
3. Grid Finish: White baked-on enamel.
4. Acceptable Product: “Donn DX/DXL” by USG Interiors, Inc., Chicago, IL, Tel: (800) 964-4874, Web: www.usg.com.

B. Suspension System Accessories:
1. Manufacturer's standard trim and edge moldings to suit suspension system requirements; same finish as suspension system.
2. Provide edge moldings to fit penetrations exactly, including circular penetrations.
3. Provide hold-down clips required for suspended grid system, where recommended by manufacturer.

2.4 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
a. Type: Postinstalled expansion anchors.
b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
c. Corrosion Protection Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400, in high humidity areas.
2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
a. Verify with Structural Drawing General Notes to verify this method of attachment is acceptable.

B. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   2. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
   3. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.135-inch- (3.5-mm-) diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

E. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

G. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels' in-place.

H. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical tile ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

B. Where work points shown on drawings, start grid layout at work point and proceed in complete modules radially from the work point to the edges of the ceiling.

3.3 SUSPENDED CEILING INSTALLATION

A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's instructions and CISCA "Ceiling Systems Handbook".
   1. Install system in accordance with ASTM C 636, except for more stringent requirements of manufacturer or these specifications.
   2. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
   3. CISCA Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies."
   4. UBC. Standard No. 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-In Panel Ceilings."

B. Install system capable of supporting imposed loads with maximum deflection of 1/360.

C. Hanger Installation:
   1. Coordinate location of hangers with other work.
   2. Secure hangers or rods as required to structural support by connecting directly to structure where possible, otherwise connect to inserts, clips or other anchorage devices or fasteners.
   3. Space hangers not more than 6-inches from each ceiling edge.
      a. Provide sufficient additional hangers for support of fixtures and other items supported by ceiling suspension system to prevent eccentric deflection or rotating of supporting runners. Provide hangers on cross-runners within 6 inches of grid intersections to support light fixtures.
   4. Hang system independent of columns, ducts, pipes, and conduit.
   5. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
   6. If ducts of other equipment prevent the regular spacing of hangers, reinforce nearest affected hangers to span extra distance.
   7. Where building expansion joints occur, provide non-continuous independent suspension support on each side of joint. Bridge joint with expansion joint trim.

D. Center system on room axis leaving equal border units, unless otherwise shown.

E. Edge Molding Installation:
   1. Install edge moldings where ceilings abut walls, partitions or other penetration elements.
   2. Miter cut inside and outside corners to provide flush, tight, hairline joints.

F. Panel Installation:
   1. Install in level and uniform plane; free from twist, warp and dents.
   2. Rest edges on flanges of tees.
   3. Support perimeters on wall moldings.
   4. Neatly scribe and cut boards for accurate fit at borders, interruptions, and penetrations by other work.
   5. Lay directional patterned units one way with pattern parallel to longest room axis.

G. Site Tolerances:
   1. Level completed assembly to tolerance of 1/8-inch in 10-feet.
   2. Variation from Plumb of Grid Members Caused by Eccentric Loads: Two degrees maximum.

H. Penetrations
   1. Center ceiling mounted devices and penetrations.
   2. At exposed penetrations provide escutcheon.

3.4 CLEANING

A. Clean exposed surfaces of exposed metal ceiling grid, trim, and edge moldings. Comply with manufacturers' instructions for cleaning and touchup of minor finish damage.

B. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented and bent units.

C. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

- END OF SECTION -

- SECTION 09 5426 -

LINEAR WOOD CEILINGS

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. Concealed suspension system for Acoustic Wood members.
   2. Wood grille ceiling panels for concealed suspension system.
   3. Trim and accessories.
   4. Seismic restraints for suspended ceiling system.

1.3 RELATED WORK

A. Section 09 5113 “Acoustic Panel Ceilings” for ceilings consisting of mineral-base and glass-fiber-base acoustical panels and exposed suspension systems.

B. Division 23 “Mechanical” for work to be coordinated with ceiling.

C. Division 26 “Electrical” for light fixture coordination.

1.4 REFERENCES

A. ASTM A 641: Standard Specification for Zinc Coated (Galvanized) Carbon Steel Wire; 1992.

B. ASTM C 423: Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 1990.

C. ASTMC C 635: Standard Specifications for Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.

D. ASTM C 636: Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels; 1992.

E. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials; 1991.

F. ASTM E 580: Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint; 1991.

G. AWI (QSI): Architectural Woodwork Quality Standards Illustrated; 2003.

H. CISCA: Ceiling Systems Handbook.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturers other than those listed in Paragraph 2.1 are required to submit for approval prior to bidding per Section One.

B. Installer Qualifications: Engage an experienced Installer, approved by wood ceiling manufacturer, who has completed panel ceilings similar in species, design, and extent to that indicated for this Project and with a record of successful in-service performance.

C. Inspection: All work must pass inspection and approval of architect, as well as the local codes and regulations or authorities having jurisdiction.

D. Single-Source Responsibility for Wood Ceiling System: Obtain each type of Acoustic Wood members from a single fabricator, with in-house Shop Drawing capabilities, in-house assembly and finishing capabilities, and with resources to provide products of consistent quality in appearance and physical properties without delaying the project.

E. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying project.

F. Pre-Installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

G. Forest Certification: Provide wood grilles produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

1.6 SUBMITTALS

A. General: Submit each item in this Section according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data: For each type of product specified.

C. Samples: For verification of each type of exposed finish required, prepared on samples of size indicated below. Where finishes involve normal color and texture variations, include sample sets showing the range of variations expected.

1. 12” x 18” samples of each panel type, pattern, and color.

D. LEED Submittals:

1. Product Data for Credit EQ 4.4:
   a. For each composite-wood product used, documentation indicating that the bonding agent contains no urea formaldehyde.
   b. For each adhesive used, documentation indicating that the adhesive contains no urea formaldehyde.
2. Product Data for Credit(s) MR 4.1 and MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content
   a. Include statement indicating costs for each product having recycled content.
3. Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.
   a. Include statement indicating costs for each certified wood product.

E. Shop Drawings & Coordination With Other Trades

1. Coordination Drawings: Reflected Ceiling Plans, Drawn To Scale, On Which The Following Items Are Shown And Coordinated With Each Other, Using Input From Installers Of The Items Involved:
   a. Linear pattern.
   b. Joint pattern.
   c. Ceiling suspension members.
   d. Method of attaching hangers to building structure.
      1) Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
   e. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, and access panels.
   f. Ceiling perimeter and penetrations through ceiling; trim and moldings.

1.7 PROJECT CONDITIONS

A. Space Enclosure and Environmental Limitations: Do not install wood panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is completed and dry, work above ceilings is complete and ambient temperature and humidity conditions are being maintained at the levels indicated for Project when occupied for its intended use.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Delivery & Unloading: Coordinate crate sizes, weights, unloading options, and delivery schedule with manufacturer prior to fabrication. Deliver wood panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other mistreatment.

B. Climatization: Before installing wood panels, permit them to reach room temperature and stabilized moisture content (at least 72 hours) per AWI standards.

C. Handling: Handle Acoustic Wood members carefully to avoid chipping edges or damaging units in any way.

1.9 EXTRA MATERIALS

A. Extra Materials: Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels clearly describing contents.
   1. Acoustic Wood members: Furnish quantity of full-size units equal to 2.0 percent of amount installed.
   2. Suspension System Components: Furnish quantity of each component equal to 2.0 percent of amount installed.

1.10 WARRANTIES

A. Warranties: Provide owner with a (1) year warranty for material and workmanship on all installed products.
   1. Manufacturers: All materials, wood ceiling and grid, shall be warranted for (1) one year for material and workmanship.
   2. Installer: All work shall be warranted for (1) year from final acceptance of completed work.

PART 2 - PRODUCTS

2.1 WOOD GRILLE CEILING PANELS

A. Basis of Design: 9Wood, Inc. Acoustic Wood, Wood Grille, 1200 Series, Wood Grille No. 1112-7
   1. Wood Grille Ceiling Panels:
      a. Species: TBD
      b. Member Size: 5/8 inch by 1-3/8 inch.
      c. Edge Profile: Square
      d. Members/LF: 7 Members per LF
      e. Assembly Style: Dowel.
      f. Fire Rating: Fire Rating Class, e.g., Class 1(A) Fire Rating.
      g. Finish: As selected by Architect.

2.2 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal T-Grid Suspension System: Provide standard interior Metal Heavy Duty 15/16” suspension T-Grid system using Main Runners, Cross-tees, Wall Angle or Shadow Moldings of types, structural classifications, and <black> finishes indicated and that comply with applicable ASTM C 635 requirements. Comply with all applicable <seismic> codes and ordinances.

B. Attachment Devices: Size for 3 times the design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

C. Wire, Braces, Ties, Hanger Rods, Flat Hangers and Angle Hangers: Provide wires, rods and hangers that comply with applicable ASTM specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: Examine substrates and structural framing to which ceilings attach or abut, with installer present, for compliance with requirements specified in this and other sections that affect ceiling installation and anchorage. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.

B. Layout: Measure each ceiling area and establish the layout of Acoustic Wood members to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and conform to the layout shown on reflected ceiling plans in accordance with wood ceiling manufacturer’s approved Shop Drawings.

3.3 INSTALLATION

A. General: Install Wood Grille Ceilings to comply with manufacturer's instructions and CISCA "Ceiling Systems Handbook."

B. Attachments: Suspend ceiling hangers from building's structural members per manufacturer’s instructions and in compliance with all local codes and regulations.

C. Installation of Metal T-Bar Grid: Install, align, brace, tie-off, mount, handle interferences, and space suspension T-Grid in accordance with suspension manufacturer’s instructions and in compliance with all local codes and regulations.

D. Installation of Wood Grille: Install Wood ceiling members in accordance with manufacturer’s installation instructions and in compliance with all local codes and regulations. Install with undamaged edges and fitted accurately to suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit, as required.

E. Suspension Runners: Install suspension system runners so they are square and securely interlocked with one another. Install number and use on-center spacing per wood ceiling manufacturer’s instructions, as indicated on approved Shop Drawings and in compliance with all local codes.

3.4 CLEANING

A. General: Comply with manufacturer's instructions for cleaning and touchup of minor finish damage. Remove and replace wood ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

- END OF SECTION -

- SECTION 09 6000 -

SOUND TRANSMISSION CONTROL MATERIALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Rebonded recycled rubber underlayment.

1.3 RELATED SECTIONS

A. Section 03 3000 “Cast-in-Place Concrete” for concrete substrates.

B. Section 09 3013 “Ceramic Tile”.

C. Section 09 6466 “Wood Athletic Flooring”.

1.4 SUBMITTALS

A. General: Submit following items in accordance with Section 01 3219.

B. Product Data: Submit product data for each product.

C. LEED Submittals:
   1. Product Data for Credit MR 4.1 and MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
      a. Include statement indicating costs for each product having recycled content.
   2. Product Data for Credit EQ 4.1: For sealants, including printed statement of VOC content.

D. Shop Drawings: Manufacturers specifications, catalog cuts and other items needed to demonstrate compliance with the specified requirements. Also include the manufacturer’s recommended installation procedures, which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the work.

E. Samples: Submit a verification sample.

1.5 PROJECT CONDITIONS

A. Temperature Requirements: Maintain air temperature in spaces where products will be installed for time period before, during and after installation as recommended by manufacturer.

B. Field Measurements: Verify actual measurements/opening by field measurements before fabrication. Show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

C. Coordinate with work as specified in Section 03 3000 “Cast-in-Place Concrete”.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: The design based on Regulpol-QTscu Rebonded Recycled Rubber Impact Sound Insulation by Dodge-Regulol Inc. Lancaster, PA tel (866) 326-5712, www.regupolqt.com.

2.2 MATERIALS

A. Rebonded Recycled Rubber Impact Sound Insulation, thickness 3/8 inch (10 mm).

B. Roll Dimension: 48 inches (1219 mm) x 15 feet (4572 mm).

C. Product Testing:
1. Laboratory Impact Insulation Class (ASTM E 492): Specified floor-ceiling assembly must be tested in a NVLAP certified laboratory and comply with ASTM standards.
2. Field Impact Insulation Class ASTM E 1007): Floor-ceiling assembly must meet requirement as stated by building code and/or acoustical consultant.
3. Shall be ICC-ES certified.
4. Shall be UL listed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and proceed with Work when substrates are ready.

B. Verify that substrate work is complete, clean, dry and installed in accordance with contract documents before beginning installation of sheet products.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with floor covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
   a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 5 lbs of water/1000 sq. ft. (2.4 kg of water/92.9 sq. m) in 24 hours.
   b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.

C. Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch (3-mm) deviation in any direction when checked with a 10-foot (3-m) straight edge.
   1. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

D. Remove coatings, including curing compounds, and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

E. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Comply with manufacturers technical manual for procedures and techniques for installation.

B. Concrete floor shall be fully cured and permanently dry. Subfloor shall be dry, clean, smooth, level and structurally sound. It should be free of dust, solvent, paint, wax, oil, grease, asphalt, sealers, curing and hardening compounds, alkaline salts, and other extraneous materials, according to ASTM F 710.

3.4 PROTECTION

A. Protect sheets from puncture during installation. Patch punctures before proceeding with subsequent construction.

3.5 SCHEDULE

A. Install beneath ceramic tile, wood athletic flooring and other locations as indicated on Drawings.

- END OF SECTION -

- SECTION 09 6466 -

WOOD ATHLETIC FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes wood sports-floor assemblies.

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for wood sports-floor assemblies.

B. Shop Drawings: Show installation details including location and layout of each type of floor assembly and accessory. Include the following:

1. Expansion provisions and trim details.
2. Layout, colors, widths, and dimensions of game lines and markers.
3. Locations of floor inserts for athletic equipment installed through flooring assembly.

C. Samples for Initial Selection: Manufacturer's color charts showing colors and glosses available for the following:

1. Floor finish.
2. Game-line and marker paint.

D. Samples for Verification: For each type of sports-floor assembly and accessory required; approximately 12 inches (300 mm) long and of same thickness and material indicated for the Work.

1. Include sample sets showing the full range of normal color and texture variations expected in wood flooring.
2. Include sample sets showing finishes and game-line paint and marker paint colors applied to wood flooring.

E. LEED Submittals:

1. Product Data for Credit EQ 4.1: For wood sports-floor assembly installation adhesives, including printed statement of VOC content.

2. Product Data for Credit EQ 4.2: For field-applied finishes and game-line and marker paints, including printed statement of VOC content.
3. Certificates for Credit MR 7: Chain-of-custody certificates certifying that wood flooring complies with forest certification requirements. Include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
   a. Include statement indicating costs for each certified wood product.

F. Qualification Data: For Installer.

G. Maintenance Data: For wood sports-floor assemblies and finish systems to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Installer Qualifications: An experienced installer who has completed wood sports-floor assembly installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in installations with a record of successful in-service performance.
1. Installer responsibilities include installation and field finishing of sports-floor assembly components and accessories, and application of game lines and markers.

C. Forest Certification: Provide wood components produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

D. Maple Flooring: Comply with MFMA grading rules for species, grade, and cut.
1. Certification: Provide flooring that carries MFMA mark on each bundle or piece.

E. Mockups: Install mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. To set quality standards for installation, install mockup of floor area as shown on Drawings.
2. To set quality standards for sanding and application of field finishes and game lines and markers, prepare finish mockup of floor area as shown on Drawings.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver assembly materials in unopened cartons or bundles.

B. Protect wood from exposure to moisture. Do not deliver wood components until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.

C. Store wood components in a dry, warm, well-ventilated, weathertight location and in a horizontal position.

1.6 PROJECT CONDITIONS

A. Conditioning period begins not less than seven days before sports-floor assembly installation, is continuous through installation, and continues not less than seven days after sports-floor installation.
   1. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F (18 and 24 deg C) and relative humidity planned for building occupants, but not less than 35 percent or more than 50 percent, in spaces to receive sports-floor assemblies during the conditioning period.
   2. Wood Conditioning: Move wood components into spaces where they will be installed, no later than beginning of the conditioning period.
      a. Do not install sports-floor assemblies until wood components adjust to relative humidity of, and are at same temperature as, spaces where they are to be installed.
      b. Open sealed packages to allow wood components to acclimatize immediately on moving wood components into spaces in which they will be installed.

B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

C. Install sports-floor assemblies after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Air Zone Maple System with Mondo Air Zone pads manufactured by Mondo American, Inc., Lynwood, WA, tel: (800) 962-5334. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
   1. Aacer Flooring, LLC.
   2. Action Floor Systems LLC.
   3. Connor Sports Flooring, Inc.
   4. Horner Flooring Company, Inc.
   5. Robbins, Inc.
   6. Superior Floor Company, Inc.

2.2 WOOD FLOORING

A. Strip Flooring: Northern hard maple (Acer saccharum), kiln dried, random length, tongue and groove, and end matched.
   1. Grade: MFMA-RL Second and Better.
   2. Cut: Flat.
   3. Thickness: 25/32 inch (20 mm).
   4. Face Width: 2-1/4 inches (57 mm)
   5. Backs: Channeled (kerfed) for stress relief.

6. Preservative Treatment: Clear, penetrating, water-repellent wood preservative that protects against mold, mildew, staining, and decay fungi; complying with MFMA's written recommendations and applied by immersion.

2.3 SUBFLOOR SYSTEM

A. Board Underlayment: Nominal 1-by-6-inch (25-by-150-mm) graded boards; of SPIB No. 2 Southern pine, WCLIB Construction grade (any species), or WWPA No. 3 (any species), dried to 15 percent moisture content.

B. Plywood Underlayment: APA rated, C-D Plugged, exterior glue, tongue and groove, 15/32 inch (12 mm) thick.

C. Resilient Pads: With air voids for resiliency and installed at manufacturer's standard spacing for product designation indicated above.
1. Type: Conical pads.
2. Material: Rubber.
3. Thickness: 1-3/16 inch (30 mm)

2.4 ACCESSORIES

A. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 6 mils (0.15 mm) thick.

B. Resilient Wall Base: Molded, vented, rubber or vinyl cove base; 3 by 4 (76 by 102 mm); with premolded outside corners.
1. Color: TBD.

C. Thresholds: As specified in Division 08 Section "Door Hardware.".

D. Fasteners: Type and size recommended by manufacturer, but not less than those recommended by MFMA for application indicated.

E. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by sports-floor manufacturer.

F. Floor-Finish System: System of compatible components recommended in writing by flooring manufacturer and MFMA approved.
1. Type: MFMA: Group 5, Water Based Finishes; polyurethane.
2. Floor-Sealer Formulation: Pliable, penetrating type.
3. Finish-Coat Formulation: Formulated for gloss finish and multicoat application.
4. Game-Line and Marker Paint: Industrial enamel compatible with finish coats and recommended in writing by manufacturers of finish coats, and paint for this use.
5. VOC content: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   a. Floor Sealers and Finish Coats: VOC content of not more than 350 g/L.
   b. Game-Line and Marker Paint: VOC content of not more than 150 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of sports-floor assemblies.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Concrete Slabs: Verify that concrete slabs comply with requirements specified in Division 3 Section "Cast-in-Place Concrete."

1. Moisture Testing:

a. Perform anhydrous calcium chloride test per ASTM F 1869, as follows:

1) Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) and perform not less than 2 tests in each installation area and with test areas evenly spaced in installation areas.

2) Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 4.5 lb of water/1000 sq. ft. (2.04 kg of water/92.9 sq. m) in 24 hours.

b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

3.2 PREPARATION

A. Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch (3-mm) deviation in any direction when checked with a 10-foot (3-m) straight edge.

1. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

B. Remove coatings including curing compounds and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone; use mechanical methods recommended by manufacturer. Do not use solvents.

C. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. General: Comply with sports-floor assembly manufacturer's written instructions, but not less than written recommendations of MFMA applicable to flooring type indicated.

B. Pattern: As indicated on Drawings.

C. Expansion Spaces: Provide as indicated, but not less than that required by manufacturer's written instructions and MFMA's written recommendations at walls and other obstructions, and at interruptions and terminations of flooring.

1. Cover expansion spaces with base molding and trim as indicated on Drawings.

D. Vapor Retarder: Install with joints lapped a minimum of 6 inches (150 mm) and sealed.

E. Underlayment: Install perpendicular to direction of flooring, staggering end joints in adjacent rows.

F. Install perimeter rows of cushions with no more than 6 inches (152 mm) from edge of sheet to center of cushion.

G. Use a minimum of 12 inches (305 mm) staples to fasten the second layer of sheathing to the first.

H. Strip Flooring: Mechanically fasten perpendicular to supports.

I. Installation Tolerances: 1/8 inch in 10 feet (3 mm in 3 m) of variance from level.

3.4 SANDING AND FINISHING

A. Follow applicable recommendations in MFMA's "Industry Recommendations for Sanding, Sealing, Court Lining, Finishing, and Resurfacing of Maple Gym Floors."

B. Allow installed flooring to acclimate to ambient conditions for at least 10 days before sanding.

C. Machine sand with coarse, medium, and fine grades of sandpaper to achieve a level, smooth, uniform surface without ridges or cups. Remove sanding dust by tack or vacuum.

D. Finish: Apply seal and finish coats of finish system according to finish manufacturer's written instructions. Provide not less than four coats total and not less than two finish coats.
   1. Water-Based Finishes: Use finishing methods recommended by finish manufacturer to reduce grain raise and sidebonding effect.
   2. Game Lines and Markers: Apply game-line and marker paint between final seal coat and first finish coat according to paint manufacturer's written instructions.
      a. Mask flooring at game lines and markers, and apply paint to produce lines and markers with sharp edges.
      b. Where game lines cross, break minor game line at intersection; do not overlap lines.
      c. Apply game lines and markers in widths and colors according to requirements indicated on Drawings.
      d. Apply finish coats after game-line and marker paint is fully cured.

3.5 PROTECTION

A. Protect sports floors during remainder of construction period to allow finish to cure and to ensure that flooring and finish are without damage or deterioration at time of Substantial Completion.
   1. Do not cover sports floors after finishing until finish reaches full cure, and not before seven days after applying last finish coat.

B. Do not move heavy and sharp objects directly over sports floors. Protect fully cured floor finishes and surfaces with plywood or hardboard panels to prevent damage from storing or moving objects over sports floors.

- END OF SECTION -

- SECTION 09 6500 -

RESILIENT FLOORING

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. Linoleum sheet flooring.

B. Related Sections:
   1. Section 03 3000 “Cast-In-Place Concrete” for floor repair materials not covered under this section.
   2. Section 09 6513 "Resilient Wall Base and Accessories" for resilient base, reducer strips, and other accessories installed with linoleum floor covering.

1.3 SUBMITTALS

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

B. LEED Submittals:
   1. Product Data for Credit MR 6.0: For linoleum flooring, including printed statement of costs for each rapidly renewable material.
   2. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.

C. Shop Drawings: For each type of floor covering. Include floor covering layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   1. Show details of special patterns.

D. Samples for Initial Selection: For each type of floor covering indicated.
   1. Include similar Samples of installation accessories involving color selection.

E. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch (152-by-230-mm) sections of each color and pattern of floor covering required.
   1. Heat-Welding Bead: Include manufacturer's standard-size Samples, but not less than 9 inches (230 mm) long, of each color required.

F. Heat-Welded Seam Samples: For each floor covering product and welding bead color and pattern combination required; with seam running lengthwise and in center of 6-by-9-inch (152-by-230-mm) Sample applied to rigid backing and prepared by Installer for this Project.

G. Product Schedule: For floor covering. Use same designations indicated on Drawings.

H. Qualification Data: For qualified Installer.

I. Maintenance Data: For each type of floor covering to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor covering installation.
   1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.

B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store floor coverings and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 90 deg F (32 deg C).
   1. Sheet Flooring: Store rolls upright.

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor coverings during the following time periods:
   1. 72 hours before installation.
   2. During installation.
   3. 72 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 72 hours after floor covering installation.

E. Install floor coverings after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Sheet Flooring: Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, in roll form and in full roll width for each color, pattern, and type of sheet flooring installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following:
   1. Altro Group.
   2. Armstrong World Industries, Inc.
   3. Tarkett, Inc.
   4. No substitutions allowed.

B. Products: Subject to compliance with requirements, provide the following:
   1. Tarkett, Inc.; Products:
      a. Veneto xf

2.2 LINOLEUM FLOOR COVERING

A. Sheet Flooring: ASTM F 2034, Type I, linoleum sheet with backing.
   1. Roll Size: In manufacturer's standard length by not less than 78 inches (1980 mm) wide.

B. Seaming Method: Heat welded.

C. Thickness: 0.10 inch (2.5 mm).

D. Colors and Patterns: As selected by Architect from full range of industry colors.

E. Finish: Topshield Finish.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit products and substrate conditions indicated.
   1. Use adhesives that have a VOC content of zero (0) g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Heat-Welding Bead: Solid-strand product of linoleum floor covering manufacturer.

1. As selected by Architect from manufacturer's full range to contrast with linoleum floor covering.

D. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor coverings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings.

B. Concrete Substrates: Prepare according to ASTM F 710.
1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with floor covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
   a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 5 lbs of water/1000 sq. ft. (2.4 kg of water/92.9 sq. m) in 24 hours.
   b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor coverings until they are same temperature as space where they are to be installed.
1. Move floor coverings and installation materials into spaces where they will be installed at least 72 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

3.3 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions for installing floor coverings.

B. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

C. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.

D. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on subfloor. Use chalk or other nonpermanent marking device.

E. Install floor coverings on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of floor covering installed on covers and adjoining floor covering. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.

F. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

G. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.

3.4 LINOLEUM SHEET FLOORING INSTALLATION

A. Unroll sheet floorings and allow them to stabilize before cutting and fitting.

B. Lay out sheet floorings as follows:
   1. Maintain uniformity of floor covering direction.
   2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (152 mm) away from parallel joints in floor covering substrates.
   3. Match edges of floor coverings for color shading at seams.
   4. Avoid cross seams.
   5. Eliminate deformations that result from hanging method used during drying process (stove bar marks).

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor coverings.

B. Perform the following operations immediately after completing floor covering installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.

3. Damp-mop surfaces to remove marks and soil.

C. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive and surface blemishes from floor coverings before applying liquid floor polish.
   1. Apply number of coats as recommended by manufacturer.

E. After allowing drying room film (yellow film caused by linseed oil oxidation) to disappear, cover floor coverings until Substantial Completion.

- END OF SECTION -

- SECTION 09 6513 -

RESILIENT WALL BASE & ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section contains Specifications for the following:
   1. Rubber wall base, straight & cove toe.
   2. Flooring transition molding.
   3. Rubber stair treads.

1.3 RELATED SECTIONS

A. Section 09 6500 "Resilient Flooring" for resilient sheet floor coverings.

B. Section 09 6566 "Rubber Athletic Flooring" for resilient floor coverings for use in athletic-activity or support areas.

1.4 SUBMITTALS

A. Product data for each type of product specified.

B. Samples for verification purposes in manufacturer's standard sample sets, but not less than 12 inches long, of each different color and pattern of product specified.

C. LEED Submittals:
   1. Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.

D. Samples for Initial Selection: For each type of product indicated.

E. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

F. Product Schedule: For resilient products. As indicated on Drawings.

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility for Products: Obtain each type and color of product specified from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

B. Fire Performance Characteristics: Provide products with the following fire performance characteristics as determined by testing products per ASTM test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Critical Radiant Flux: 0.45 watts per sq. cm or more per ASTM E 648.
   2. Smoke Density: Less than 450 per ASTM E 662.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in original manufacturer's unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store products in dry spaces protected from the weather with ambient temperatures maintained between 50 deg F and 90 deg F.

C. Move products into spaces where they will be installed at least 48 hours in advance of installation.

1.7 PROJECT CONDITIONS

A. Maintain a minimum temperature of 70 deg F in spaces to receive products specified in this Section for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. After this period, maintain a temperature of not less than 55 deg F.

B. Do not install products until they are at the same temperature as that of the space where they are to be installed.

C. Close spaces to traffic during installation of products specified in this Section.

1.8 SEQUENCING AND SCHEDULING

A. Sequence installing products specified in this Section with other construction to minimize possibility of damage and soiling during remainder of construction period.

1.9 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials matching products installed as described below, packaged with protective covering for storage, and identified with labels clearly describing contents.
   1. Furnish not less than 10 linear feet for each 500 linear feet or fraction thereof of each different type and color of resilient wall base installed.
   2. Deliver extra materials to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products specified in each Product Data Sheet at end of this Section.

2.2 RESILIENT WALL BASE

A. Rubber Wall Base: Products complying with FS SS-W-40, Type I, and requirements specified in the Rubber Wall Base Product Data Sheet at end of this Section.

2.3 RESILIENT MOLDING ACCESSORIES

A. Description: Carpet edge for carpet tile applications and reducer strip for resilient floor covering.
   1. Johnsonite, Rubber DC.
   2. Burke Mercer Flooring Products; Type TS
   3. Roppe Corporation; Series 50, Transition Strips and stair treads.

B. Material: Rubber.

C. Colors: Refer to drawings.

2.4 RESILIENT STAIR ACCESSORIES

A. Resilient Stair Treads:
   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. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
      b. Endura Rubber Flooring; Division of Burke Industries, Inc.
      c. Estrie Products International; American Biltrite (Canada) Ltd.
      d. Flexco, Inc.
      e. Johnsonite.
      f. Mondo Rubber International, Inc.
      g. Musson, R. C. Rubber Co.
      h. Nora Rubber Flooring; Freudenberg Building Systems, Inc.
      i. PRF USA, Inc.
      j. R.C.A. Rubber Company (The).
      k. Roppe Corporation, USA.
      l. VPI, LLC; Floor Products Division.

B. Resilient Stair Treads Standard: ASTM F 2169.

1. Material Requirement: [Type TV (vinyl, thermoplastic)] [Type TS (rubber, vulcanized thermoset)] [Type TP (rubber, thermoplastic)] [Type TS (rubber, vulcanized thermoset) or Type TP (rubber, thermoplastic)].
2. Surface Design:
   a. Class 1, Smooth (flat).
   b. Class 2, Pattern: [Raised-disc design] [Raised-square design] [Raised-chevron design] [Raised-diamond design] [Raised-rib design] [Raised-rib design with abrasive strips] <Insert pattern>.
3. Manufacturing Method: [Group 1, tread with embedded abrasive strips] [Group 2, tread with contrasting color for the visually impaired].

C. Nosing Style: .

D. Nosing Height: .

E. Thickness: .

F. Size: Lengths and depths to fit each stair tread in .

G. Risers: Smooth, flat, ; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

1. Thickness: [0.125 inch (3.2 mm)] [0.080 inch (2.0 mm)].

H. Stringers: Of same thickness as risers, height and length after cutting to fit risers and treads and to cover stair stringers; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

I. Colors and Patterns: Refer to drawings.

2.5 INSTALLATION ACCESSORIES

A. Concrete Slab Primer: Nonstaining type as recommended by flooring manufacturer.

B. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturers for applications indicated.

C. Adhesives: Water-resistant type recommended by manufacturer to suit resilient flooring product and substrate conditions indicated.

D. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where installation of products specified in this Section will occur, with Installer present, to verify that substrates and conditions are satisfactory for installation and comply with manufacturer's requirements and those specified in this Section.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with manufacturer's installation specifications for preparing substrates indicated to receive products indicated.

B. Use trowelable leveling and patching compounds per manufacturer’s directions to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

D. Broom or vacuum clean substrates to be covered immediately before installing products specified in this Section. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.

E. Concrete Substrates for Stair Accessories: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
3. Moisture Testing:
    a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

F. Apply concrete slab primer, if recommended by flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

G. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1. Do not install resilient products until they are the same temperature as the space where they are to be installed.

H. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1. Do not install resilient products until they are the same temperature as the space where they are to be installed.

3.3 RESILIENT WALL INSTALLATION

A. General: Install products specified in this Section using methods indicated according to manufacturer's installation directions.

B. Apply resilient wall base to walls, columns, pilasters, casework, and other permanent fixtures in rooms and areas where base is required. Install wall base in lengths as long as practicable. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
   1. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
   2. Install premolded exterior corners before installing straight pieces.

C. Place resilient accessories so they are butted to adjacent materials of type indicated and bond to substrates with adhesive. Install reducer strips at edges of flooring that otherwise would be exposed.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing installation:
   1. Remove visible adhesive and other surface blemishes using cleaner recommended by manufacturers of resilient product involved.
   2. Sweep or vacuum floor thoroughly.
   3. Do not wash floor until after time period recommended by manufacturer.
   4. Damp-mop resilient accessories to remove black marks and soil.

B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended by manufacturer of resilient product involved.
   1. Apply protective floor polish to resilient accessories that are free from soil, visible adhesive and surface blemishes.
      a. Use commercially available metal, cross-linked, acrylic product acceptable to resilient accessory manufacturer.
      b. Coordinate selection of floor polish with Owner's maintenance service.
   2. Cover resilient accessories on floors and stairs with undyed, untreated building paper until inspection for Substantial Completion.

C. Do not move heavy and sharp objects directly over stair accessories. Place plywood or hardboard panels over surfaces and under objects while they are being moved. Slide or roll objects over panels without moving panels.

D. Clean products specified in this Section not more than 4 days prior to dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products using method recommended by manufacturer.
   1. Strip protective floor polish that was applied after completing installation, prior to cleaning.
   2. Reapply floor polish after cleaning.

3.6 RUBBER WALL BASE PRODUCT DATA SHEET

STYLE: Burke Mercer Flooring Products; Division of Burke Industries, Inc Rubber Wall base, Type-TP, Cove toe and topset.

MINIMUM NOMINAL THICKNESS: 1/8 inch.

HEIGHT: 4 inches, unless noted otherwise.

PROFILE: Coved at resilient flooring and concrete floors, straight at carpet.

LENGTHS: Coils in lengths standard with manufacturer but not less than 100 feet. Score corners.

Exterior Corners: Pre-molded.

Interior Corners: Mitered.

JOINTS: Minimize joints. No joints in corners.

ACCEPTABLE MANUFACTURERS: Johnsonite, Burke Mercer, Duramax, Roppe

COLORS: Refer to drawings.

- END OF SECTION -

- SECTION 09 6566 -

RUBBER ATHLETIC FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Interlocking, rubber floor tile.

B. Related Sections include the following:
   1. Division 9 Section "Resilient Wall Base and Accessories" for wall base and accessories installed with floor coverings.
   2. Division 9 Sections for resilient floor coverings installed in areas other than athletic-activity spaces.

1.3 SUBMITTALS

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

B. Shop Drawings: Show installation details and locations of the following:
   1. Border tiles.
   2. Floor patterns.
   3. Locations of floor inserts for athletic equipment.

C. Samples for Initial Selection: For each type of floor covering indicated.

D. Samples for Verification: For each type, color, and pattern of floor covering indicated, 6-inch-(150-mm-) square Samples of same thickness and material indicated for the Work.

E. LEED Submittals:
   1. Credit EQ 4.1: Manufacturers' product data for adhesives, including printed statement of VOC content.
   2. Credit EQ 4.2: Manufacturers' product data for game-line and marker paints, including printed statement of VOC content.
   3. Product Data for Credit MR 4.1: For products having recycled content, documentation indicating percentages by weight of post-consumer and pre-consumer recycled content.
      a. Include statement that indicates costs for each product having recycled content.

F. Maintenance Data: For floor coverings to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Basic installation procedures and tools are the same as for other standard commercial resilient flooring.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.

B. Store materials to prevent deterioration. Store tiles on flat surfaces.

1.6 PROJECT CONDITIONS

A. Install floor coverings after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Floor Tile: Furnish no fewer than 1 box or fraction thereof, of each type, color, pattern, and size of floor tile installed.

PART 2 - PRODUCTS

2.1 INTERLOCKING, RUBBER FLOOR TILE

A. MATERIALS Basis-of-Design Product: The design is based on ECO Surfaces Commercial Flooring; Ecostone as manufactured by Dodge-Regupol, Inc Lancaster, PA 17601. Phone: 1-877-7873.www.ecosurfaces.com

B. Material: Recycled-rubber compound. 100% post consumer SBR tire rubber and 30% pre-consumer ColorMill EPDM. Single ply, non-laminated.

C. Installation Method: Loose lay.

D. Traffic-Surface Texture: Textured.

E. Size: As selected by Architect.

F. Thickness: 1/4 inch (6 mm)

G. Color and Pattern: TBD

2.2 INSTALLATION ACCESSORIES

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by tile manufacturer for applications indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of floor coverings.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Alkalinity and Adhesion Testing: Perform tests recommended in writing by manufacturer. Proceed with installation only after substrates pass testing.
   3. Moisture Testing:
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
         1) Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) and perform not less than 2 tests in each installation area and with test areas evenly spaced in installation areas.
      b. Perform tests recommended in writing by manufacturer. Proceed with installation only after substrates pass testing.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation, unless manufacturer recommends a longer period in writing.
   1. Do not install floor coverings until they are same temperature as space where they are to be installed.

F. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 FLOOR COVERING INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions.

B. Scribe, cut, and fit floor coverings to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.

C. Extend floor coverings into toe spaces, door reveals, closets, and similar openings, unless otherwise indicated.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on floor coverings. Use nonpermanent, nonstaining marking device.

3.4 FLOOR TILE INSTALLATION

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
   1. Lay tiles in pattern indicated.

B. Discard broken, cracked, chipped, or deformed tiles.

C. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered.

3.5 CLEANING AND PROTECTING

A. Perform the following operations immediately after completing floor covering installation:
   1. Sweep and vacuum floor coverings thoroughly.
   2. Damp-mop floor coverings to remove marks and soil.
      a. Do not wash floor coverings until after time period recommended in writing by manufacturer.

B. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
   1. Do not move heavy and sharp objects directly over floor coverings. Protect floor coverings with plywood or hardboard panels to prevent damage from storing or moving objects over floor coverings.

- END OF SECTION -

- SECTION 09 6813 -

TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:
   1. Modular, tufted carpet tile.

1.3 RELATED SECTIONS

A. Section 09 6513 – Resilient Wall Base and Accessories for resilient wall base and accessories installed with carpet tile.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate.

B. Shop Drawings: Show the following:
   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
   2. Carpet tile type, color, and dye lot.
   3. Type of subfloor.
   4. Type of installation.
   5. Pattern of installation.
   6. Pattern type, location, and direction.
   7. Pile direction.
   8. Type, color, and location of insets and borders.
   9. Type, color, and location of edge, transition, and other accessory strips.
   10. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Carpet Tile: Full-size Sample.
   2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- long Samples.

D. LEED Submittal:
   1. Product Data for Credit EQ 4.3:
      a. For carpet tile, documentation indicating compliance with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.
      b. For installation adhesive, including printed statement of VOC content.
   2. Product Data for Credit MR 4.1 and MR 4.2: Recycled content.

E. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

F. Qualification Data: For Installer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.

H. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

I. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104, Section 5, "Storage and Handling."

1.7 PROJECT CONDITIONS

A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."

B. Environmental Limitations: Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Vapor pressure test.

E. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.8 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, dimensional stability, excess static discharge, and delamination.
   3. Warranty Period: Lifetime.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Basis-of-Design Product: Subject to compliance with requirements, provide Collins & Aikman A Tandus Company, Dalton, GA, tel: (800) 248-2878
   1. Infinity Kaleidoscope 05849-55021 (small pattern).
   2. Calypso Kaleidoscope 05165-23607 (large pattern).
   3. Voyager Ganymede 05158-20605 (small pattern).
   4. Odyssey Ganymede 05163-14520 (large pattern).
   5. Infinity Olive Grove 05849-55013 (small pattern).
   6. Colors: Refer to Drawings.

B. Carpet Tile: Infinity Kaleidoscope
   1. Total Recycled Content: (Post-industrial and post-consumer) 30-50%.
   2. Primary Backing: Non-Woven synthetic fiber.
   3. Size: TBD.
   4. Applied Soil-Resistance Treatment: Ensure
   5. Construction: Textured Patterned Loop
   6. Gauge: 1/13
   7. Stitched per Inch: 9.5
   8. Pile Height Average: 0.117 inch
   9. Fiber System: TDX Nylon
   10. Dye Method: 60% Solution Dyed/40% Yarn Dyed
   11. Soil/Stain Protection: Ensure

C. Carpet Tile: Calypso Kaleidoscope
   1. Total Recycled Content: (Post-industrial and post-consumer) 30-50%.

2. Primary Backing: Non-Woven synthetic fiber.
3. Size: TBD.
4. Applied Soil-Resistance Treatment: Ensure
5. Construction: Accuweave Patterned Loop
6. Gauge: 1/12
7. Stitched per Inch: 6.9
8. Pile Height Average: 0.187 inch
9. Fiber System: TDX Nylon
10. Dye Method: 55% Solution Dyed/45% Yarn Dyed
11. Soil/Stain Protection: Ensure

D. Carpet Tile: Voyager Ganymede
1. Total Recycled Content: (Post-industrial and post-consumer) 30-50%.
2. Primary Backing: Non-Woven synthetic fiber.
3. Size: TBD.
4. Applied Soil-Resistance Treatment: Ensure
5. Construction: Textured Patterned Loop
6. Gauge: 1/13
7. Stitched per Inch: 8.4
8. Pile Height Average: 0.117 inch
9. Fiber System: TDX Nylon
10. Dye Method: 60% Solution Dyed/40% Yarn Dyed
11. Soil/Stain Protection: Ensure

E. Carpet Tile: Odyssey Ganymede
1. Total Recycled Content: (Post-industrial and post-consumer) 30-50%.
2. Primary Backing: Non-Woven synthetic fiber.
3. Size: TBD.
4. Applied Soil-Resistance Treatment: Ensure
5. Construction: Textured Patterned Loop
6. Gauge: 1/13
7. Stitched per Inch: 9.5
8. Pile Height Average: 0.117 inch
9. Fiber System: TDX Nylon
10. Dye Method: 60% Solution Dyed/40% Yarn Dyed
11. Soil/Stain Protection: Ensure

F. Carpet Tile: Infinity Olive Grove
1. Total Recycled Content: (Post-industrial and post-consumer) 30-50%.
2. Primary Backing: Non-Woven synthetic fiber.
3. Size: TBD.
4. Applied Soil-Resistance Treatment: Ensure
5. Construction: Textured Patterned Loop
6. Gauge: 1/13

7. Stitched per Inch: 8.7
8. Pile Height Average: 0.117 inch
9. Fiber System: TDX Nylon
10. Dye Method: 65% Solution Dyed/35% Yarn Dyed
11. Soil/Stain Protection: Ensure

H. Performance Characteristics: As follows:
1. Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
2. Dimensional Stability: 0.1 percent or less per ISO 2551 (Aachen Test).
3. Noise Reduction Coefficient (NRC): per ASTM C 423.
4. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) per AATCC 16, Option E.
5. Electrostatic Propensity: Less than 3.0 kV per AATCC 134.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesive Squares: Compounded acrylic adhesive, applied to PET polyester backing with PET polyester release liner. Tiles as manufactured by Tandus Company.
1. Dimensions: 3-inch by 3-inch.
2. Solids: Greater than 99%.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
4. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
5. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 5 lbs of water/1000 sq. ft. (2.4 kg of water/92.9 sq. m) in 24 hours.

b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Install Tiles as recommended by the manufacturer. Install tiles at 1/4 turn and as indicated on the Drawings. For walk-off mat, install with releasable adhesive as recommended by manufacturer.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protection of Indoor Installations."

1. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

- END OF SECTION -

- SECTION 09 6816 -

SHEET CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Tufted carpet.

1.3 RELATED SECTIONS

A. Division 09 Section "Tile Carpeting."

B. Section 09 6513 – Resilient Wall Base and Accessories for resilient wall base and accessories installed with carpet tile.

1.4 SUBMITTALS

A. Product Data: For the following, including installation recommendations for each type of substrate:
   1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.

B. Shop Drawings: Show the following:
   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
   2. Carpet type, color, and dye lot.
   3. Seam locations, types, and methods.
   4. Type of subfloor.
   5. Type of installation.
   6. Pattern type, repeat size, location, direction, and starting point.
   7. Pile direction.
   8. Type, color, and location of insets and borders.
   9. Type, color, and location of edge, transition, and other accessory strips.
   10. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Carpet: 12-inch- (300-mm-) square Sample.
   2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- (300-mm-) long Samples.
   3. Carpet Seam: 6-inch (150-mm) Sample.
   4. Mitered Carpet Border Seam: 12-inch- (300-mm-) square Sample. Show carpet pattern alignment.

D. LEED Submittals:
   1. Product Data for Credit EQ 4.3:
      a. For carpet, documentation indicating compliance with testing and product requirements of Carpet and Rug Institute's "Green Label Plus" program.
      b. For carpet cushion, documentation indicating compliance with testing and product requirements of Carpet and Rug Institute's "Green Label" program.
      c. For installation adhesive, including printed statement of VOC content.

E. Product Schedule: For carpet. Use same designations indicated on Drawings.

F. Qualification Data: For Installer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.

H. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet.

I. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to carpet installation including, but not limited to, the following:
   1. Review delivery, storage, and handling procedures.
   2. Review ambient conditions and ventilation procedures.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104, Section 5, "Storage and Handling."

1.7 PROJECT CONDITIONS

A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."

B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.8 WARRANTY

A. Special Warranty for Carpet: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, and delamination.
3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TUFTED CARPET

A. Basis-of-Design Product: Subject to compliance with requirements, provide Collins & Aikman A Tandus Company, Dalton, GA, tel: (800) 248-2878

B. Carpet: Infinity/Voyager Group

1. Construction: Textured Patterned Loop
2. Gauge: 1/13
3. Stitched per Inch: 9.5
4. Pile Height Average: 0.117 inch
5. Fiber System: TDX Nylon
6. Dye Method: 60% Solution Dyed/40% Yarn Dyed
7. Primary Backing: ER3 Non-Woven synthetic fiber.
   a. Total Recycled Content: (Post-industrial and post-consumer) 30-50%.
8. Size: 6 foot roll.

9. Applied Soil-Resistance Treatment: Ensure
10. Colors:
    a. Kaleidoscope 05849-55021
    b. Olive Grove 05849-55013

C. Carpet Tile: Calypso Kaleidoscope
1. Construction: Accuweave Patterned Loop
2. Gauge: 1/12
3. Stitched per Inch: 6.9
4. Pile Height Average: 0.187 inch
5. Fiber System: TDX Nylon
6. Dye Method: 55% Solution Dyed/45% Yarn Dyed
7. Primary Backing: ER3 Non-Woven synthetic fiber.
    a. Total Recycled Content: (Post-industrial and post-consumer) 30-50%.
8. Size: 6 foot roll.
9. Applied Soil-Resistance Treatment: Ensure
10. Color: Kaleidoscope 05165-23607

D. Carpet Tile: Voyager Ganymede
1. Construction: Textured Patterned Loop
2. Gauge: 1/13
3. Stitched per Inch: 8.4
4. Pile Height Average: 0.117 inch
5. Fiber System: TDX Nylon
6. Dye Method: 60% Solution Dyed/40% Yarn Dyed
7. Primary Backing: ER3 Non-Woven synthetic fiber.
    a. Total Recycled Content: (Post-industrial and post-consumer) 30-50%.
8. Size: 6 foot roll.
9. Applied Soil-Resistance Treatment: Ensure
10. Color: Ganymede 05158-20605

E. Carpet Tile: Odyssey Ganymede
1. Construction: Textured Patterned Loop
2. Gauge: 1/13
3. Stitched per Inch: 9.5
4. Pile Height Average: 0.117 inch
5. Fiber System: TDX Nylon
6. Dye Method: 60% Solution Dyed/40% Yarn Dyed
7. Primary Backing: ER3 Non-Woven synthetic fiber.
    a. Total Recycled Content: (Post-industrial and post-consumer) 30-50%.
8. Size: 6 foot roll.
9. Applied Soil-Resistance Treatment: Ensure.
10. Color: Ganymede 05163-14520

F. Performance Characteristics: As follows:
   1. Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
   2. Dimensional Stability: 0.1 percent or less per ISO 2551 (Aachen Test).
   3. Noise Reduction Coefficient (NRC): per ASTM C 423.
   4. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) per AATCC 16, Option E.
   5. Electrostatic Propensity: Less than 3.0 kV per AATCC 134.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.
   1. VOC Limits: Provide adhesives with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

C. Tackless Carpet Stripping: Water-resistant plywood, in strips as required to match cushion thickness and that comply with CRI 104, Section 12.2.

D. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

E. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Alkalinity and Adhesion Testing: Perform tests recommended in writing by manufacturer. Proceed with installation only after substrates pass testing.
   3. Moisture Testing:
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

1) Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) and perform not less than 2 tests in each installation area and with test areas evenly spaced in installation areas.

4. Perform tests recommended in writing by manufacturer. Proceed with installation only after substrates pass testing.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

3.3 INSTALLATION

A. Comply with CRI 104 and carpet manufacturer's written installation instructions for the following:

1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."

B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

C. Do not bridge building expansion joints with carpet.

D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.

3.4 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing carpet:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
   2. Remove yarns that protrude from carpet surface.
   3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with CRI 104, Section 16, "Protection of Indoor Installations."

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet adhesive manufacturer.

- END OF SECTION -

- SECTION 09 8100 -

ACOUSTICAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Glass fiber acoustic board.
   2. Fiberglass sound batts.

1.3 RELATED SECTIONS

A. Section 07 2100 “Thermal Insulation” for thermal insulation applications.

1.4 SUBMITTALS

A. Product data for each type of insulation product specified.

B. Samples: Submit manufacturer’s sample, minimum 6 inches square.

C. Product test reports from and based on tests performed by qualified independent testing laboratory evidencing compliance of fire performance characteristics, and other properties, based on comprehensive testing of current products.

D. LEED Submittal:

1. Product Data for Credit MR 4.1 and MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

   a. Include statement indicating costs for each product having recycled content.

1.5 QUALITY ASSURANCE

A. Fire Performance Characteristics: Provide insulation materials identical to those whose indicated fire performance characteristics have been determined per the ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organization.
   1. Surface Burning Characteristic: ASTM E 84.
   2. Fire Resistance Ratings: ASTM E 119.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's recommendations for handling, storage, and protection during installation.

PART 2 - PRODUCTS

2.1 WOOL ACOUSTICAL BOARD MATERIALS

A. Manufacturers: Subject to compliance with requirements, provide the following:
   1. SelectSound Black Acoustic Board, by Owens Corning, One Owens Corning Parkway, Toledo, Ohio 43659, Tel: 1-800-GET-PINK, www.owenscorning.com.
   2. Thickness: 2”

B. Performance Requirements
   1. Board shall be available in 24” x 48” and 48” x 96” sizes.
   2. Acoustic board thickness shall have a Standard density of 3.0 pcf.
   3. Product shall be dimensionally stable with no capability for shrinking or warping.
   4. Product shall have a resilient composition with good resistance to damage from job-site impact.
   5. Product shall be composed of inorganic glass fibers.
   6. Product's mat face shall be able to be cleaned by vacuuming.
   7. Product shall not be susceptible to rot or mildew contamination.
   8. Product shall not cause corrosion greater than caused by sterile cotton to steel and aluminum, when tested in accordance with ASTM C665.
   9. Acoustical Performance (Tested to ASTM C423, Type A mounting).
   10. Surface Burning of Core Material (tested to UL 723, or CANIULC-S102-M):
      a. Flame spread 25, smoke developed 50.
   11. Water vapor sorption - by weight (Tested to ASTM C1104):
      a. <3% at 120°F (49°C) at 95% relative humidity.
   12. Fungi resistance
      a. Meets all requirements of ASTM C1338.

2.2 FIBERGLASS INSULATION

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

1. Manufacturers of Glass Fiber Wall Insulation:
   a. Johns Manville Insulations (Sound Shield Batts, 4" thick).
   b. Owens/Corning Fiberglas Corp. (Sound Attenuation Batts, 3-1/2" thick).
   c. CertainTeed Corp. (CertaSound Attenuation Batts, 3-1/2" thick).

B. MATERIALS

1. Sound Attenuation Batts: Fiberglass, unfaced, with a Fire Hazard Classification of 250-50 or less when tested in accordance with ASTM E-84-89a, Standard Test Method for Surface Burning Characteristics of Building Materials; ASTM C-665-88 Standard Specification for Mineral Fiber Blanket Thermal Insulation, Type 1, Class B, and Federal Specification HH-I-521F, Type I.

2.3 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.4 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:

1. Products:
   a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
   b. Eckel Industries of Canada; Stic-Klip Type N Fasteners.
   c. Gemco; Spindle Type.

2. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.

B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.

1. Products:
   a. AGM Industries, Inc.; RC150.
   b. AGM Industries, Inc.; SC150.
   c. Gemco; Dome-Cap.
   d. Gemco; R-150.
   e. Gemco; S-150.

2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap.

C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.
   1. Products:
      a. AGM Industries, Inc.; TACTOO Adhesive.
      b. Eckel Industries of Canada; Stic-Klip Type S Adhesive.
      c. Gemco; Tuff Bond Hanger Adhesive.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's instructions applicable to products and application indicated. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with installation of insulation.

B. Extend insulation full thickness as indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement.

C. Install acoustical insulation batts in all stud partition walls. Install batts prior to installing gypsum panels unless batts are readily installed after panels have been installed on one side.

3.2 SCHEDULE

A. General: When spaces are also scheduled for building thermal insulation, install insulation as specified in Section 07 2100 “Thermal Insulation”.
   1. Interior Partitions: Install Sound Attenuation Batts, from floor to underside of deck as noted on Drawings.

- END OF SECTION -

- SECTION 09 9113 -

EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes surface preparation and field painting of the following:
   1. Exposed exterior items and surfaces.
   2. Surface preparation of new surfaces, priming, and finish coats specified in this Section are in addition to prepping, shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Owner's Representative will select from standard colors and finishes available.
   1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
   2. Painting includes exposed concrete foundation from below grade up to siding.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
   1. Prefinished items include the following factory-finished components:
      a. Acoustical panels.
      b. Metal toilet enclosures.
      c. Metal lockers.
      d. Finished mechanical and electrical equipment.
      e. Light fixtures.
      f. Distribution cabinets.
   2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
      a. Foundation spaces.
      b. Furred areas.

c. Ceiling plenums.
d. Utility tunnels.
e. Pipe spaces.
f. Duct shafts.

3. Finished metal surfaces include the following:
   a. Anodized aluminum.
   b. Stainless steel.
   c. Chromium plate.
   d. Copper.
   e. Bronze and brass.
4. Operating parts include moving parts of operating equipment and the following:
   a. Valve and damper operators.
   b. Linkages.
   c. Sensing devices.
   d. Motor and fan shafts.
5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.3 RELATED SECTIONS

A. Section 09 9600 “High-Performance Coatings” for exterior special paint coatings for walls, floors, ceilings and other applications.

1.4 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

B. MPI: The Master Painters Institute, Approved Product List-2005

1.5 SUBMITTALS

A. Product Data: For each paint system specified. Include block fillers and primers.
   1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
   2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

B. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
   1. Provide Samples of each color defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.

C. LEED Submittal:

1. Product Data for Credit EQ 4.2: For paints, including printed statement of VOC content and chemical components

D. At completion of Work of this Section, submit manufacturer's or distributors numbered invoices showing type and quantity of products used on this Project.

1.6 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated for new construction and re-finished surfaces.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Project Manager of problems anticipated using the materials specified.

D. Field Samples: Provide a full-coat benchmark finish sample of each type of coating and substrate required on the Project. Comply with procedures specified in PDCA P5. Duplicate finish of approved prepared samples.

1. The Project Manager will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted. Apply coatings in this room or surface in accordance with the schedule or as specified. After finishes are accepted, this room or surface will be used for evaluation of coating systems of a similar nature.

E. Material Quality: Provide the manufacturer's best quality, top of the line paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.8 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.

C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.9 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.

B. Quantity: Furnish the Owner with 10 gallons of each color or type applied. Containers must be delivered unopened

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. MATERIALS Basis-of-Design Product: The design is based on Kelly-Moore Paints, San Carlos, CA, tel: (888) 677-2468, www.kellymoore.com. District Standard – No substitutions allowed.

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.

1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
    a. Clean all exterior surfaces to be refinished of all dirt, dust, oil, grease, oxidized loose and scaly paint film, mildew, rust on metal and other foreign substances.

C. Repairs: Repair all cracks, holes and voids in surfaces to be refinished with suitable and matching repair compounds to insure permanency to the surfaces compatible to the painting systems to follow. Fill, float, sand and texture to match adjacent surfaces. Allow repair compounds to fully dry prior to priming and applying final coats of paint.

D. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
    a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
    b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
    a. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    b. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.
4. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

E. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
   1. Paint colors, surface treatments, and finishes: Refer to Drawings.
   2. Provide finish coats that are compatible with primers used.
   3. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.
   4. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
   5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
   6. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   7. Paint surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
   8. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
   9. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

C. Minimum Coating Thickness: Apply paint materials no thinner than manufacturers recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer and specified.

D. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.
   1. Mechanical items to be painted include, but are not limited to, the following:
      a. Piping, pipe hangers, and supports.
      b. Heat exchangers.
      c. Tanks.
      d. Ductwork.
      e. Motors and mechanical equipment.

f. Accessory items.

2. Electrical items to be painted include, but are not limited to, the following:
   a. Conduit and fittings.
   b. Switchgear.
   c. Panelboards.

E. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

F. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

G. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

3.4 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

A. Protect unpainted surfaces, lawns, shrubbery and adjacent surfaces against paint and damage. Repair damage resulting from inadequate protection.

B. Furnish sufficient drop cloths, shields, and protective equipment to prevent overspray or splatter from damaging surfaces not being painted.

C. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Project Manager.

D. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA Standard P1-92 “Touch-Up Painting and Damage Repair – Financial Responsibility”.

3.6 EXTERIOR PAINT SCHEDULE

A. Ferrous Metals – Refer to Section 09960 High-Performance Coatings.

B. Galvanized Metals – Refer to Section 09960 High-Performance Coatings.

3.7 CLEANING AND PROTECTION

A. During course of work, remove discarded coating materials, rubbish, cans, rags and similar construction waste from the site at the end of each workday.

B. Upon completion of the coating work, clean window glass or other coating splattered surfaces. Protect work of other trades, whether to be coated or not, against damage by coating and finishing work. Correct any damage by cleaning, repairing or replacing, and recoating, as acceptable to the Owner's Representative.

- END OF SECTION -

- SECTION 09 9123 -

INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes surface preparation and field painting of the following:
   1. Exposed interior items and surfaces.
   2. Surface preparation of new surfaces, priming, and finish coats specified in this Section are in addition to prepping, shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Owner's Representative will select from standard colors and finishes available.
   1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
   2. Painting includes exposed concrete foundation from below grade up to siding.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
   1. Prefinished items include the following factory-finished components:
      a. Acoustical panels.
      b. Metal toilet enclosures.
      c. Metal lockers.
      d. Finished mechanical and electrical equipment.
      e. Light fixtures.
      f. Distribution cabinets.
   2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
      a. Foundation spaces.
      b. Furred areas.

c. Ceiling plenums.
d. Utility tunnels.
e. Pipe spaces.
f. Duct shafts.

3. Finished metal surfaces include the following:
   a. Anodized aluminum.
   b. Stainless steel.
   c. Chromium plate.
   d. Copper.
   e. Bronze and brass.
4. Operating parts include moving parts of operating equipment and the following:
   a. Valve and damper operators.
   b. Linkages.
   c. Sensing devices.
   d. Motor and fan shafts.
5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.3 RELATED SECTIONS

A. Section 09 9600 “High-Performance Coatings” for interior special paint coatings for walls, floors, ceilings and other applications.

1.4 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.

B. MPI: The Master Painters Institute, Approved Product List-2005

1.5 SUBMITTALS

A. Product Data: For each paint system specified. Include block fillers and primers.
   1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
   2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

B. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
   1. Provide Samples of each color defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.

C. LEED Submittal:

1. Product Data for Credit EQ 4.2: For paints, including printed statement of VOC content and chemical components

D. At completion of Work of this Section, submit manufacturer's or distributors numbered invoices showing type and quantity of products used on this Project.

1.6 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated for new construction and re-finished surfaces.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify Project Manager of problems anticipated using the materials specified.

D. Field Samples, Interior: Provide a full-coat benchmark finish sample of each type of coating and substrate required on the Project. Comply with procedures specified in PDCA P5. Duplicate finish of approved prepared samples.

1. The Project Manager will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted. Apply coatings in this room or surface in accordance with the schedule or as specified. After finishes are accepted, this room or surface will be used for evaluation of coating systems of a similar nature.

E. Material Quality: Provide the manufacturer's best quality, top of the line paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.8 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.

C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.9 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.

B. Quantity: Furnish the Owner with 10 gallons of each color or type applied. Containers must be delivered unopened

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. MATERIALS Basis-of-Design Product: The design is based on Kelly-Moore Paints, San Carlos, CA, tel: (888) 677-2468, www.kellymoore.com. District Standard – No substitutions allowed.

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.

1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

a. Clean all interior surfaces to be refinished of all dirt, dust, oil, grease, oxidized loose and scaly paint film, mildew, rust on metal and other foreign substances.

C. Repairs: Repair all cracks, holes and voids in surfaces to be refinished with suitable and matching repair compounds to insure permanency to the surfaces compatible to the painting systems to follow. Fill, float, sand and texture to match adjacent surfaces. Allow repair compounds to fully dry prior to priming and applying final coats of paint.

D. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.

2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.

b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.

3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.

a. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

b. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

4. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

E. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes: Refer to Drawings.
2. Provide finish coats that are compatible with primers used.
3. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
4. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.
5. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
6. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
7. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
8. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
9. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
10. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

C. Minimum Coating Thickness: Apply paint materials no thinner than manufacturers recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer and specified.

D. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.
1. Mechanical items to be painted include, but are not limited to, the following:
a. Piping, pipe hangers, and supports.
b. Heat exchangers.

c. Tanks.
d. Ductwork.
e. Motors and mechanical equipment.
f. Accessory items.

2. Electrical items to be painted include, but are not limited to, the following:
   a. Conduit and fittings.
   b. Switchgear.
   c. Panelboards.

E. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

F. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

G. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

H. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

3.4 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

A. Protect unpainted surfaces, lawns, shrubbery and adjacent surfaces against paint and damage. Repair damage resulting from inadequate protection.

B. Furnish sufficient drop cloths, shields, and protective equipment to prevent overspray or splatter from damaging surfaces not being painted.

C. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Project Manager.

D. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA Standard P1-92 “Touch-Up Painting and Damage Repair – Financial Responsibility”.

3.6 INTERIOR PAINT SCHEDULE

A. Plaster & Gypsum Wallboard Walls and Ceilings:

Primer Coat	Acry-Plex PVA primer/sealer	971
2 Coats	Dura-Poxy + 100% Acrylic Eggshell Enamel	1686

B. Plaster & Gypsum Wallboard Walls and Ceilings at wet areas:

Primer Coat	Acry-Plex PVA primer/sealer	971
2 Coats	Dura-Poxy + 100% Acrylic Semi-Gloss Enamel	1685

C. Interior Metals:

Primer Coat	Acry-Shield 100% Acrylic Metal Primer	1725
2 Coats	Dura-Poxy + 100% Acrylic Semi-Gloss Enamel	1685

3.7 CLEANING AND PROTECTION

A. During course of work, remove discarded coating materials, rubbish, cans, rags and similar construction waste from the site at the end of each workday.

B. Upon completion of the coating work, clean window glass or other coating splattered surfaces. Protect work of other trades, whether to be coated or not, against damage by coating and finishing work. Correct any damage by cleaning, repairing or replacing, and recoating, as acceptable to the Owner's Representative.

- END OF SECTION -

- SECTION 09 9600 -

HIGH PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes surface preparation and painting of the following:
   1. Exposed exterior metals (ferrous and non-ferrous).
   2. Gypsum board walls and ceilings within Chemical Storage Rooms.
   3. Interior sealed concrete where shown on plans.
   4. Epoxy flooring where is shown on plans.

1.3 SUBMITTALS

A. Product Data: For each coating system indicated. Include block fillers and primers.
   1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference the specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
   2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each material specified.

B. Certification by manufacturer that products supplied comply with requirements indicated that limit the amount of VOCs in coating products.

C. Samples for Verification: Of each color and material to be applied, with texture to simulate actual condition, on representative samples of the actual substrate.
   1. Submit samples on the following substrates for Architect's review of color and texture:
      a. Ferrous and Nonferrous Metal: Provide two 4-inch square samples of flat metal and two 8-inch long samples of solid metal for each color and finish.
      b. Concrete: Provide two 4-inch- (100-mm-) square samples for each color and finish.

D. At completion of Work of this Section, submit manufacturer's or distributor's numbered invoices showing type and quantity of products used on this Project.

E. LEED Submittals:

1. Product Data for Credit EQ 4.2: For coatings, including printed statement of VOC content and chemical components.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed high-performance coating system applications similar in material and extent to those indicated for Project and whose work has a record of successful in-service performance.

B. Source Limitations: Obtain primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label with the following information:

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect materials from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and applying coatings.

1.6 PROJECT CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 45 and 95 deg F or manufacturers recommendations.

B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Allow wet surfaces to dry thoroughly and attain temperature and conditions specified before proceeding with or continuing coating operation.

1.7 EXTRA MATERIALS

A. Furnish extra high-performance coating materials from the same production run as materials applied and in quantities described below. Package coating materials in unopened, factory-sealed containers for storage and identify with labels describing contents.

1. Quantity: Furnish an additional 10 gallons, as appropriate, of each material and color applied. Contractor shall furnish two copies of the mixing formula to the Architect in addition to the instructions attached to paint containers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated in the coating system descriptions.
   1. Carboline Company (Carboline).
   2. ICI Dulux Paints; Devoe Coatings (ICI).
   3. Pittsburgh Paint; PPG Industries, Inc. (PPG).
   4. Tnemec Company, Inc.
   5. General Polymers, a Sherwin Williams Company.

2.2 COATINGS MATERIALS, GENERAL

A. Material Compatibility: Provide primers, undercoats, and finish-coat materials 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.

B. Material Quality: Provide manufacturer's highest grade of the various high-performance coatings specified. Materials not displaying manufacturer's product identification are not acceptable.
   1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. VOC Classification: Provide high-performance coating materials, including primers, undercoats, and finish-coat materials, that have a VOC classification of 250 g/L or less.

2.3 COLORS

A. Colors: Refer to Drawings.

2.4 EXTERIOR HIGH-PERFORMANCE COATING SYSTEMS

A. Specification is based on products manufactured by Carboline Company and distributed by Vista Paint Corporation.

B. Ferrous Metal: Provide the following finish system in dry mil thicknesses as shown, over exterior ferrous-metal surfaces:

1 coat	Carboline Carboguard 890N Cycloaliphatic Amine Epoxy Primer	(min. 4 dry mils)
1 coat	Carboline Carbothane 134 VOC Aliphatic Acrylic Polyurethane	(max. 3 dry mils)

C. Non-Ferrous and Galvanized Metal: Provide the following finish system in dry mil thicknesses as shown, over exterior non-ferrous-metal surfaces:

1 coat	Carboline Galoseal WB Wash Primer	(min. 4 dry mils)
1 coat	Carboline Carbothane 134 VOC Aliphatic Acrylic Polyurethane	(max. 3 dry mils)

D. All exterior exposed metals (ferrous and non-ferrous) shall be painted with products specified above in this section.

2.5 INTERIOR HIGH-PERFORMANCE COATING SYSTEMS

A. Gypsum Board: Provide the following finish system in dry mil thicknesses shown, over interior gypsum board surfaces shown to receive EP finish:

Primer Coat	Carboline Carbocrylic 120 Primer	(1.5 dry mils)
2 Coats	Carboline Sanitile 255 WB Epoxy Finish	(5 dry mils each coat; total 10 dry mils)

B. Concrete Floors (SC-1 Finish): Provide the following finish systems over interior concrete surfaces where indicated:

1. Moderate environments for mild environments with low-gloss finish: One pigmented finish coat over a primer.
   a. Primer: Acrylic primer applied at spreading rate recommended by manufacturer.
      1) Carboline: Carboguard 1340 Poly – Amine Epoxy.
      2) ICI: Devflex 4020 DTM Flat Interior/Exterior Waterborne Primer and Finish.
      3) PPG: 6-603 Speedhide Interior/Exterior Acrylic Latex Alkali Resistant Primer.
      4) Tnemec: Series 29 Tufcryl Acrylic Emulsion.
   b. Topcoat: Semigloss acrylic emulsion applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 1.5 to 4.0 mils (0.038 to 0.102 mm).
      1) Carboline: Sanitile 945 Epoxy Coating.
      2) ICI: Devflex 4206 Interior/Exterior Waterborne Acrylic Semigloss Enamel.
      3) PPG: 90-4XX Series Pitt-Tech One Pack Interior/Exterior High Performance Waterborne Satin DTM Industrial Enamel.
      4) Tnemec: Series 29 Tufcryl Acrylic Emulsion.

PART 3 - EXECUTION

3.1 EXAMINATION

A. With Applicator present, examine substrates and conditions under which high-performance coatings will be applied, for compliance with coating application requirements.
   1. Apply coatings only after unsatisfactory conditions have been corrected and surfaces to receive coatings are thoroughly dry.
   2. Start of application is construed as Applicator's acceptance of surfaces within that particular area.

B. Coordination of Work: Review other Sections in which primers or other coatings are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of specified finish materials to ensure compatible primers.

3.2 PREPARATION

A. General: Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
   1. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.

B. Cleaning: Before applying high-performance coatings, clean substrates of substances that could impair bond of coatings. Remove oil and grease before cleaning.
   1. Schedule cleaning and coating application so dust and other contaminates from cleaning process will not fall on wet, newly coated surfaces.

C. Surface Preparation: Clean and prepare surfaces to be coated according to manufacturer's written instructions for each substrate condition and as specified.
   1. Provide barrier coats over incompatible primers or remove primers and reprime substrate.
   2. Ferrous-Metal Substrates: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.
   3. Nonferrous-Metal Substrates: Clean nonferrous and galvanized surfaces according to manufacturer's written instructions for the type of service, metal substrate, and application required.
   4. Cementitious Substrates: Prepare concrete, brick, concrete masonry block, and cement plaster surfaces to be coated. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods to prepare surfaces.
      a. Use abrasive blast-cleaning methods if recommended by coating manufacturer.

b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not coat surfaces if moisture content exceeds that permitted in manufacturer's written instructions

D. Material Preparation: Carefully mix and prepare coating materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
3. Use only the type of thinners approved by manufacturer and only within recommended limits.
4. Coating colors, surface treatments, and finishes are indicated in the coating system descriptions.
5. Provide finish coats compatible with primers used.
6. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, grilles, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
   a. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
   b. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

E. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required is the same regardless of application method.
   a. Omit primer on metal surfaces that have been shop primed and touchup painted.
   b. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
   c. Where manufacturer's written instructions require sanding, sand between applications to produce a smooth, even surface.
   d. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat does not cause undercoat to lift or lose adhesion.
2. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance. Give special attention to edges, corners, crevices, welds, exposed fasteners, and similar surfaces to ensure that they receive a dry film thickness equivalent to that of flat surfaces.

F. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
   1. Brush Application: Use brushes best suited for material applied and of appropriate size for the surface or item being coated.
      a. Apply primers and first coats by brush unless manufacturer's written instructions permit using roller or mechanical applicators.
      b. Brush out and work brush coats into surfaces in an even film.
      c. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.
   2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for the material and texture required.
   3. Spray Equipment: Use mechanical methods to apply coating if permitted by manufacturer's written instructions and governing regulations.
      a. Use spray equipment with orifice size recommended by manufacturer for material and texture required.
      b. Apply each coat to provide the equivalent hiding of brush-applied coats.
      c. Do not double back with spray equipment building-up film thickness of two coats in one pass, unless recommended by manufacturer.

G. Minimum Coating Thickness: Apply each material no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by manufacturer, to material required to be coated or finished that has not been prime coated by others.
   1. Recoat primed and sealed substrates if there is evidence of suction spots or unsealed areas in first coat, to ensure a finish coat with no burn-through or other defects caused by insufficient sealing.

J. Insert requirements for electrostatically applying coatings on metal substrates if process is acceptable to manufacturer.

K. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

L. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

A. General: Apply high-performance coatings according to manufacturer's written instructions.
   1. Use applicators and techniques best suited for the material being applied.

2. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.
3. Apply second coat only after the first coat is thoroughly dry.

3.4 CLEANING

A. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
   1. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

3.5 PROTECTION

A. Protect work of other trades, whether being coated or not, against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
   1. Provide "Wet Paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings provided by others to protect their work.
   2. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces. Comply with procedures specified in PDCA P1.

- END OF SECTION -